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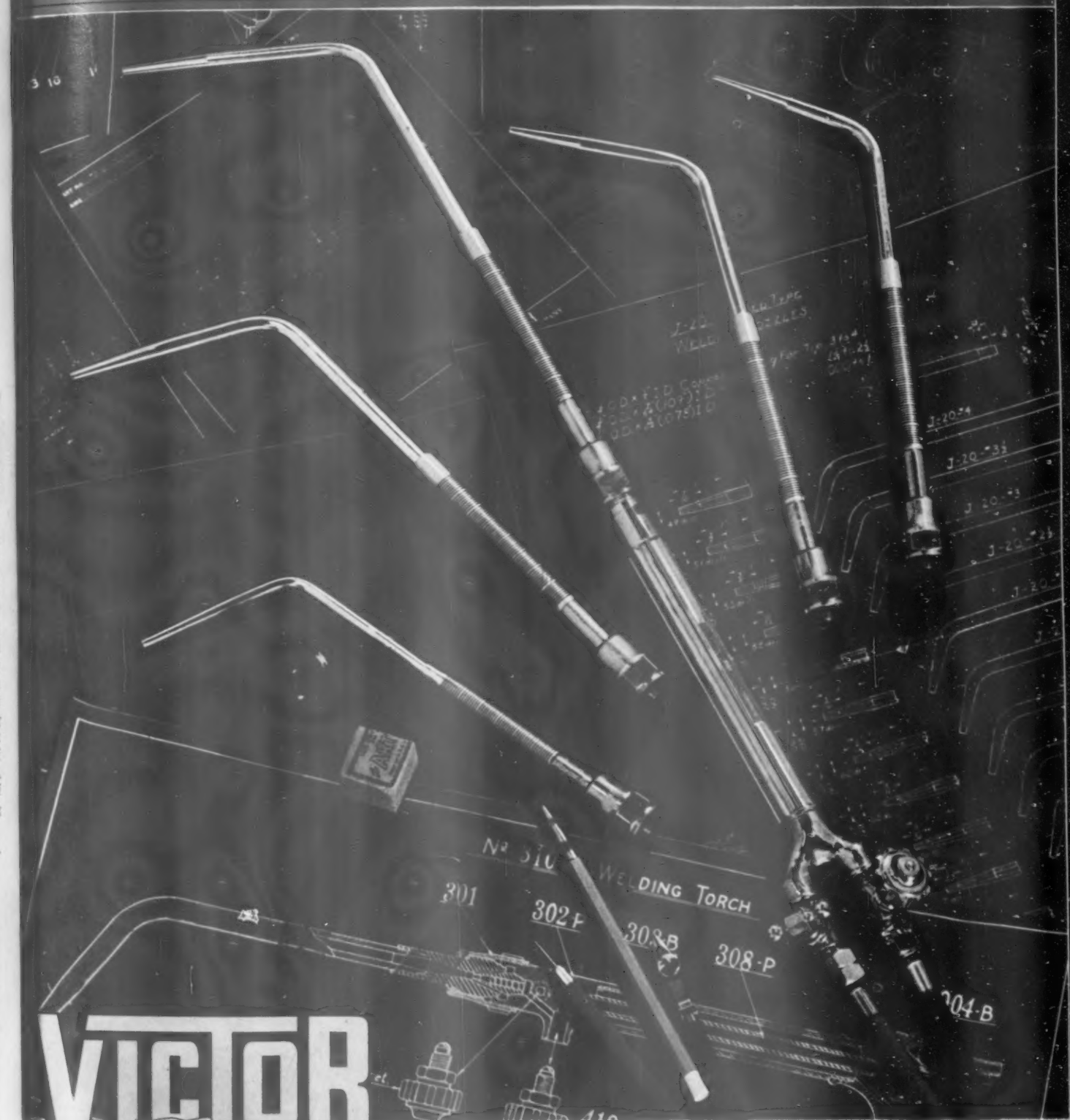
The Welding Engineer

APRIL, 1944

THE PIONEER TECHNICAL PUBLICATION OF THE WELDING INDUSTRY



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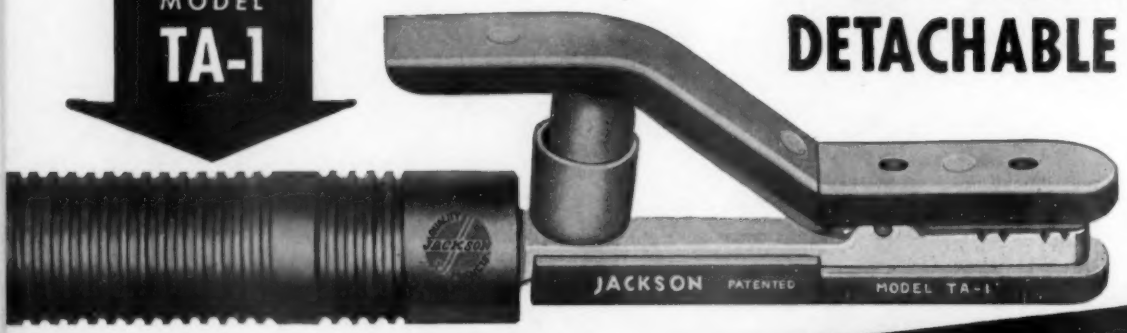

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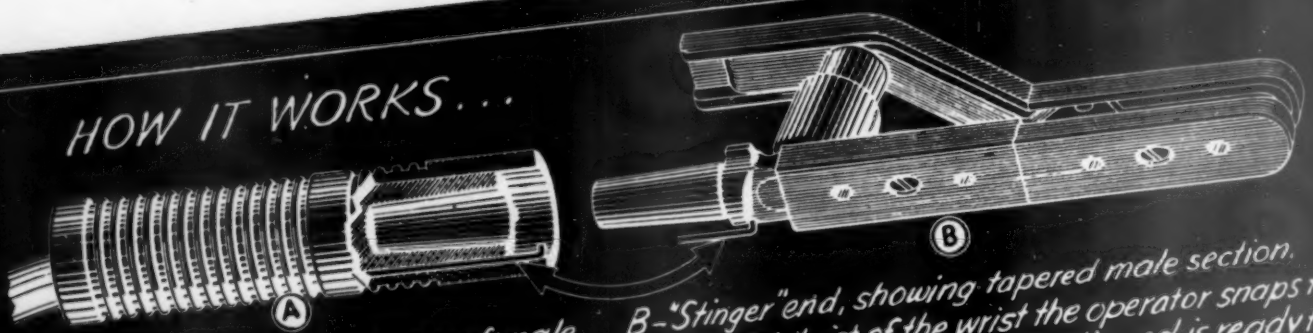
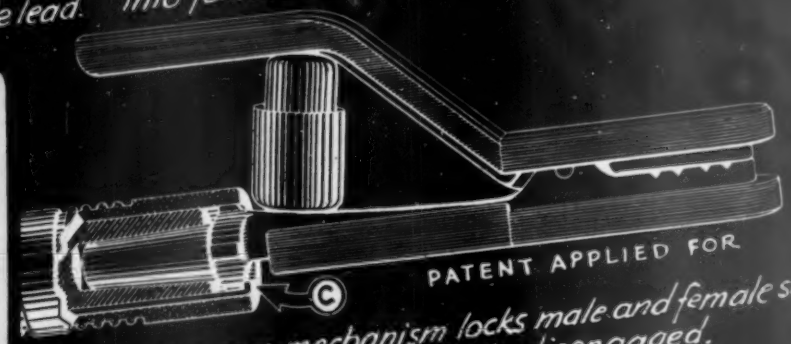


A - Insulated handle, containing female section of tapered cable connector which is soldered to cable lead.

B - "Stinger" end, showing tapered male section. With a quick twist of the wrist the operator snaps this into female section in handle (A) - and is ready to go.



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C - Actuating cam mechanism locks male and female sections. It locks TIGHT - is quickly disengaged.

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The Welding Engineer

AMERICA'S PIONEER WELDING JOURNAL

Established 1916

3% Isn't Bad

"The evil that men do lives after them;
"The good is oft interred with their bones;"

Probably truer words were never written than these from Marc Anthony's funeral oration. A good job or a good deed is hardly noticed, or if noticed soon forgotten, for we are expected to do good. On the other hand, if we fail or make a mistake, our shortcomings are taken up quickly and aired all over town. "It is worse than a crime; it is a blunder" seems to typify the general attitude toward mistakes. A rather shortsighted attitude because the man who never makes an error is also the one who never does anything.

But what about the mistakes made by those whose chief business is to criticize the mistakes of others? Can they be let off so easily?

Some people hold the opinion that our shipbuilders made a mistake when they adopted welding so extensively for the current shipbuilding program. Many reporters, though ignorant of the facts and lacking the technical education to understand them, are nevertheless willing to pass on any half-truthful information which happens to come their way.

A juicy headline such as "Liberty Ships Unsafe—Faulty Welding" is loaded with sensationalism but assays very low in truth content. The statement would be due cause for public alarm if true but, untrue, its only effect is to tear down home-front morale. *That* job it performs very successfully.

Welded Liberty ships have made the headlines several times recently—never on the basis of how well so many of them have served but rather on how poorly a few have done. America is told that four or five ships have broken up at sea, but nothing is being said about the 2,800 which are standing up to everything expected of them. And if a welded ship does break in two—well, riveted ships break, too. They did it long before welding was thought of as a ship-fabricating process, and they do it today. Is it just to put all the blame on welding?

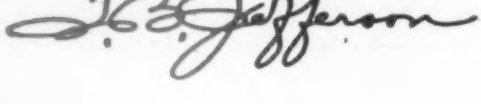
The public is told that welded ships crack open. Yes, some 65 out of 2,800 did crack open, but they got back to port. Strange that most of these cracks developed on return trips from Russia when the ships were only half ballasted with salt water! Maybe the cracks wouldn't have occurred if the ships had come back loaded with badly needed pulpwood. Anyway, cracks aren't peculiar to welded ships. Ask some of the old sea dogs about the plates that cracked open on the S. S. *Leviathan* and the S. S. *Majestic*—both riveted ships.

A little arithmetic will show that less than 3% of the Liberties in service are "mistakes"—even if you want to call every complaint a mistake. That is an excellent record.

Green labor and welding have resulted in a 10,500 ton cargo vessel every 28 days. Back in the days of World War I, riveted construction required 243 days to build a ship. That wouldn't have been good enough to deliver the goods— to save Britain in the Battle of Britain, to save Africa in the Battle of Egypt and to turn the tide at Stalingrad, Moscow and Leningrad.

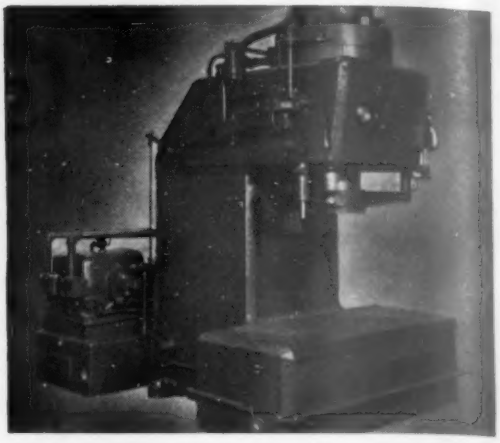
Think back, you critics of mistakes! Think back and thank God that we have welding and the men and women with foresight enough to develop it and skill enough to use it. Think how differently history would have been written if we had not had the 2,800 good ships along with those 3% in error.

No, 3% isn't bad. If some of those in high places in Washington had only made the same percentage of error, the present war picture might be looking much better.



THE QUANTITY PRODUCTION of electrodes to meet the requirements of war production has been, of course, our chief concern. Research and development work has not been neglected, however, and a continuous program devoted to the improvement of present electrodes and the creation of new ones is carried on continuously at our modern research laboratory in Woodbridge, N. J.

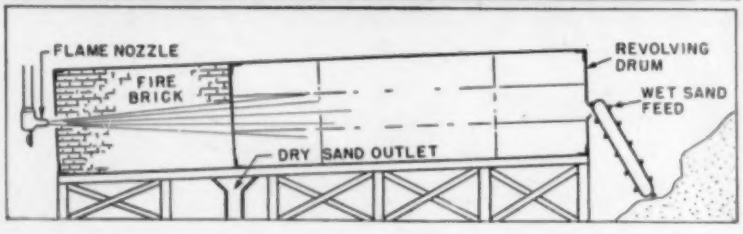
As a result of this important work, announcements of several new Murex electrodes will be made in the near future.



OILGEAR SPECIAL 200-300-TON GOOSENECK PRESS for straightening large, long tubes. Welded frame is made of steel plates from 1½" to 5" thick, is normalized after welding at 160° F. for about 8 hours and then sandblasted. ¼" Murex Fillex, 5/16" Murex Fillex and ¼" Murex Genex are used.

ERECTION OF A 30,000-TON UNIT SYNTHETIC RUBBER PLANT, one of six built by the Blaw-Knox Company, required approximately 11 miles of piping ranging in size from 2" to 30" which called for over 26,000 welds. These piping systems required designs for a wide variety of conditions, such as high pressures and temperatures, refrigeration, vacuum, hazardous liquids, gases and corrosive chemicals. Murex electrodes were used.

(Below) **WELDS IN SAND DRYER WITHSTAND HEAT EXTREMES AND ABRASION.** 450 tons of sand pass through this revolving dryer cylinder during eight hours' operation at red heat temperature which sometimes drops below zero after shutdown. Welded with Murex Molex electrodes, the welds outlast the dryer's half-inch steel liner plates. The liner plates are made in three segments, with a girth weld and 3 horizontal welds for each section.



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★ RESEARCH

Stress relieving is a necessity for large pressure vessels such as this 181,000 lb cracking tower. This welded product is 102 ft 4⅝ in. high and 10 ft in diameter, reducing to 8 ft 9 in. at the top. The shell thickness tapers from 1-17/32 to 29/32 in. After welding, the seams are X-rayed for possible defects, and the tower is stress relieved.

Why Stress Relieve?

Two experts in the pressure vessel field discuss one of today's most controversial topics. They answer such questions as when and where to stress relieve and give helpful hints on the proper methods and temperatures.

By **A. E. BEDELL** *and* **J. B. QUIGLEY**

Chief Engineer and Welding Supervisor, respectively, of the Graver Tank & Manufacturing Co.

CONTRARY to widely accepted belief, residual stresses in welded or riveted structures and vessels do not present entirely new or novel problems. Iron and steel castings, rolled structural steel shapes and ceramic products are only some of the widely used materials which normally retain residual stresses set up during their cooling periods.

Stresses in steel castings, in particular, are very analogous to those encountered in welded structures, and it has been the accepted practice of years for foundrymen to relieve such stresses in a furnace. This stress relieving, carried out either as a separate operation or as incidental to heat treating, has eliminated almost entirely the difficulties encountered in the early days of the steel casting art when poor machinability, cracking and frailability under either extremely high or low temperature service conditions were commonly prevalent.

What Are Internal Stresses?

The phrase "internal residual stresses" is a very comprehensive one and has been, and no doubt will continue to be, the subject of considerable study and research. Nevertheless, for the purpose of the present article, internal residual stresses can be briefly, if broadly, defined as a "system of balanced forces existing within the body of a structure even though it is not subject to any working loads."

It is not within the scope of this article to discuss in technical detail the subject of residual stresses: their cause, nature or phenomena. Many papers have been written and investigations made; many more are now under way. In spite of voluminous data thus made available, there is still much to be learned. The conclusion reached in most articles (either candidly admitted by the authors or decided upon by the perplexed reader) is that the problem is "terrifically complicated." But, whatever the nature of such stresses and whatever their causes, there is unanimity of opinion that they should be, insofar as possible, eliminated.

Much has been written and innumerable discussions have been held on the causes of failures in welded structures — particularly in those structures, which, due to their size or other considerations, were not stress relieved. A bewildering number of reasons for failures have unquestionably been unearthed, always in various combinations. While residual stresses shoulder the major blame, inferior workmanship, poor or unsuitable materials and poor design are usually important contributing factors.

Whether or not these initially unavoidable and inherent residual stresses are serious depends upon the ultimate service for which the member or structure is utilized. Unfortunately, there is no practical non-destructive method of evaluating residual stress in a structure. Even two seemingly similar members (due to fundamental differences in the material, fabrication procedure and/or welding sequence) will not retain the same residual stresses. Each structure, therefore, presents its own individual problem, to be judged by considering its inherent residual stress in combination with its particular service conditions.

When to Stress Relieve

If the combined residual and load stresses approach the yield point, the necessity for stress relieving of some nature is clearly indicated. Particular-

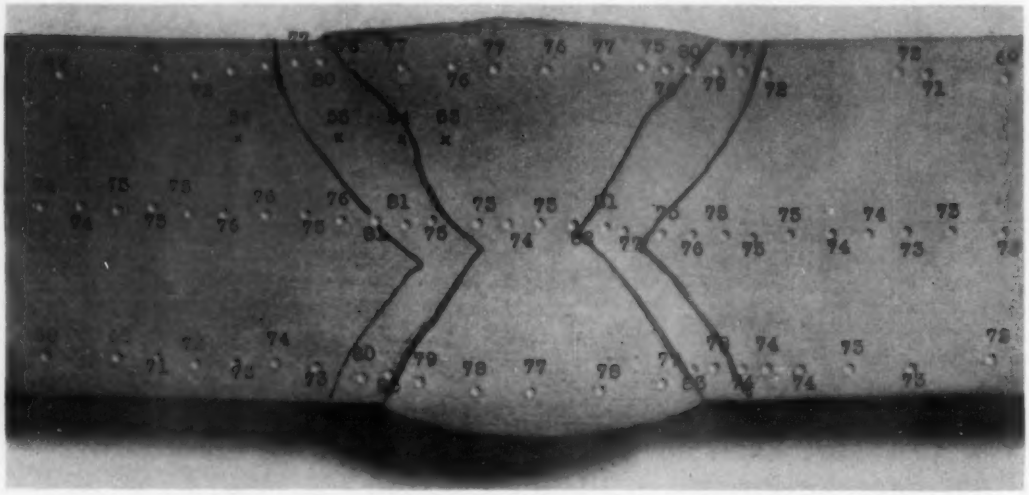


Fig. 1—Macrograph of test material as welded. The boundaries of the weld metal and the heat-affected zones were intensified by outlining in ink, and the numbers give the Rockwell B hardnesses at the points indicated. The crosses (Nos. 53, 54, 55, 56) mark the location of the photomicrographs—Figs. 3, 4, 5, and 6, respectively.

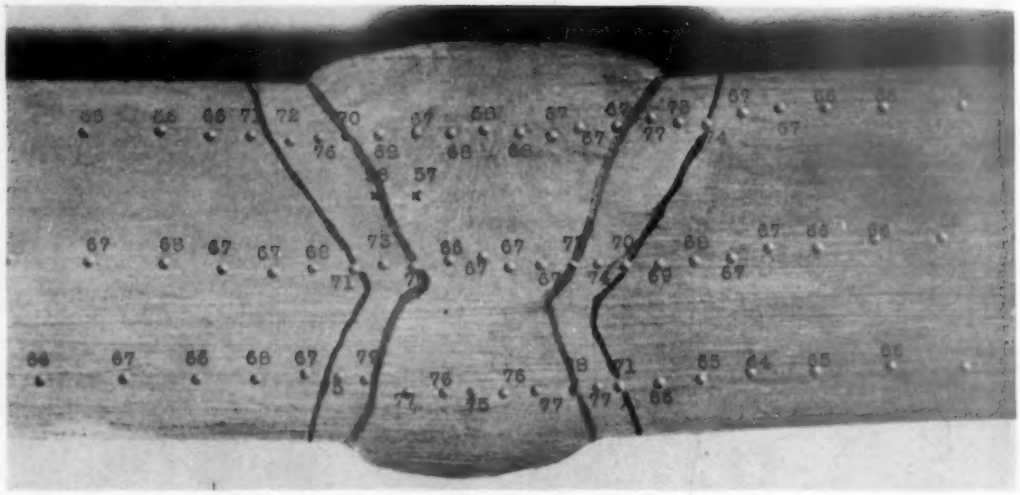


Fig. 2—Macrograph of stress-relieved test weld. As in Fig. 1, the numbers give the Rockwell B hardnesses at the points indicated, and the crosses (Nos. 57, 58) mark the location of photomicrographs—Figs. 7 and 8.

ly is this true in cases: (1) where the loads are suddenly applied, (2) where subsequent machining operations remove metal under shrinkage stress (which makes for redistribution of stress and subsequent distortion in services involving extremely high or low temperatures), (3) where the structure or vessel is subject to wide variations in operating temperatures and (4) where it is to be utilized under certain corrosive conditions.

While it is true that there have been instances where stress relieving was unjustified, there are many more cases where stress relieving should have been applied, not only as an additional factor of safety but as a means of prolonging the life of the equipment.

As previously pointed out, stress relieving is equally desirable in castings, riveted or welded structures, or riveted or welded vessels. The following discussion is confined primarily to welded steel vessels or structures, but the principles, methods, results and advantages of stress relieving are fundamental in all of these types of materials and structures.

Sources of Stresses

Metal deposited by welding, either by gas or arc, reacts as a cast metal, since the parent metal serves as a mold even though it is firmly fused to the weld. As in any cast metal, the deposited metal shrinks as it cools—the shrinkage being volumetric and in all directions. Hence, since the weld and parent metal are fused into a homogeneous mass, the drawing of the deposited metal leaves residual stresses in the welded structure when the cooling is complete.

Another source of residual stresses is the irregular cooling of the metal adjacent to the weld zone, which has been partially heated during the welding process. The nature of the resistance of such surrounding areas to the distortion caused by heating and cooling obviously affects the nature and magnitude of the resultant stresses. The type of welding process, its rate of application and the sequence of the welding operations are also important factors.

While it is fundamental that residual welding stresses may be reduced to a minimum by the proper design of welded joints and structures and by utilization of proper welding procedure and welding technique, it is just as obvious that it is generally impossible to eliminate such stresses entirely by merely taking precautions in design or fabrication. Hence further measures are frequently necessary.

Stresses Augment Corrosion

The belief that residual stresses will automatically eliminate themselves in time is all too prevalent. It is true that there is a slight tendency in this direction, but the process is so slow at room temperature or at normal operating temperatures as to be of no practical value. Therefore, some means of reducing the internal stresses to a minimum is clearly desirable and, in fact, is absolutely essential in most cases where: (1) the necessary design and construction of a welded structure result in inherently large residual stresses or (2) the structure is subject to sudden or repeated shocks, to extreme temperature changes or to most types of corrosion.

While it is a difficult matter to

prove by laboratory methods that greater corrosion occurs when vessels are under stress, the fact has been demonstrated by actual experience beyond question of doubt. It has been the almost universal experience of all users that numerous failures have occurred in using non-stress-relieved containers under corrosive conditions whereas there have been comparatively few failures with stress-relieved tanks.

The reason for this is highly involved. It has been proved that there is no marked difference in corrosion resistance between pieces of strained and unstrained metal which have been cut and insulated from contact with other materials. On the other hand, this is not true under actual service conditions in which portions of the strained metal are in contact with the unstrained. The stressed material usually becomes anodic to the unstressed metal, and localized corrosion takes place.

The most logical explanation for this is that there are, in theory, two different metals in welded steel vessels: one the plate or parent metal, which is relatively unstressed, and the other the weld metal and nearby heat-affected area, which are more or less highly stressed. Since the two are in contact with one another in a solid solution, galvanic action takes place between the positive (stressed) and the negative (unstressed) plates, resulting in localized corrosion.

Stress relieving reduces the hardness of both the weld deposit and the heat-affected zone. This makes the entire grain structure more stable, reducing the galvanic action and attendant corrosion in solution.

Stress-Relieving Methods

There are numerous generally accepted methods of partially or substantially eliminating residual stresses. The most common of these are hot peening, stressing the base metal beyond its yield point by mechanical, hydrostatic or other suitable methods, annealing, normalizing and, finally, stress relieving. The terms "annealing," "normalizing" and "stress relieving" are frequently, but erroneously, considered analogous processes. However, there is a distinct technical

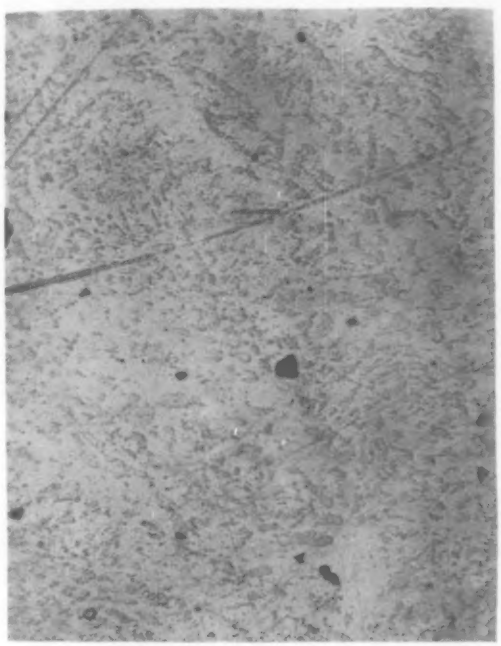


Fig. 3. (left)—Photomicrograph of as-welded deposited weld metal at the point shown by Cross 53 in Fig. 1. A low-carbon steel of fine grain throughout is indicated. Comparison with the weld metal on the stress-relieved sample (Fig. 7) indicates that the cementite within the pearlite has a tendency to coagulate or "spheroidize" when stress relieved. Magnification, 100 X.

Fig. 7 (right)—Weld metal after stress relieving (Cross 57 in Fig. 2). Comparison with Fig. 3 shows the tendency toward spheroidizing which occurred as a result of stress relieving. Magnification, 100 X.

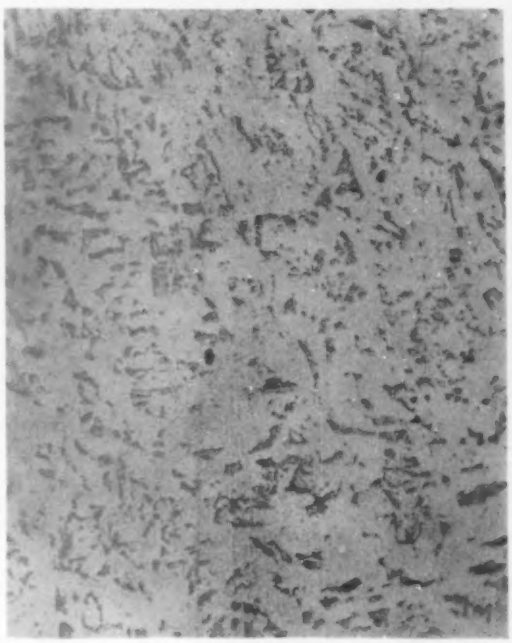


Fig. 4 (left)—Photomicrograph of the heat-affected zone adjacent to the weld (Cross 54 in Fig. 1). Comparison with Fig. 8 shows that the coarse-grain structure was not appreciably changed by stress relieving. Magnification, 100 X.

Fig. 8 (right)—Heat-affected zone after stress relieving (Cross 58 in Fig. 2). Comparison with Fig. 4 shows that the coarse-grain structure of the latter was not appreciably changed, though spheroidizing occurred. Magnification, 100 X.

difference: the temperatures used for annealing and normalizing are above the critical range whereas temperatures for stress relieving are below this range.*

It can be demonstrated that, with the exception of a few isolated cases or where the stress relieving is purely of a local nature, the simplest, most economical and most satisfactory

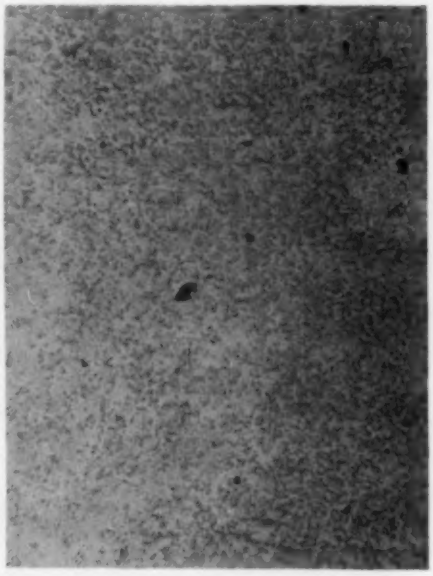


Fig. 5—Photomicrograph of area further removed from the weld (Cross 55 in Fig. 1). Note the fine-grain structure of the outer heat-affected zone as indicated here. Magnification, 100 X.

method is by some sort of stress-relief heat treatment. Both annealing and normalizing relieve residual stresses, in some respects better than stress relieving, but since such treatments are carried out beyond the critical temperature range, they involve changes in grain structure and tend to produce heavy scale. Likewise, these two related processes tend to produce dimensional changes of serious nature, even approaching collapse in certain types of structures. In practically all cases, consequently, stress relieving is the best and most practicable method of reducing residual welded stresses.

Codes for Pressure Vessels

The importance, and in some cases the necessity, of stress relieving is recognized by the ASME and API codes, and credit is given for increased joint efficiency of stress-relieved vessels. For full details of the stress-relieving requirements as covered by these codes, reference may be made to Paragraphs U-68, U-76 and U-87 of the ASME Code for Unfired Pressure Vessels, 1940 Edition, and Paragraphs W-316, W-318.1, W-318.2, W-462 and W-517. Space will not be taken here to discuss these code requirements as such information is readily available to anyone interested. It should be noted, however, that the code requirements cover the temperature ranges which are affected by the nature of the metal, the time element as affected by thickness of plate involved and limiting conditions if the whole structure is not stress relieved as a unit.

Many structures that require stress relieving do not fall under the jurisdiction of any code, or, as quite frequently happens, vessels built in accordance with code requirements may present special problems not comprehensively covered by the particular code. It is therefore apparent that the manufacturer entrusted with the task of stress relieving must fully understand the underlying principles involved and have a comprehensive knowledge of the individual problems that may be encountered with every vessel or structure so treated.

Recovery and Relaxation

The principal benefits of stress relieving are in "recovery" and "relaxation." Any welded structure contains shrinkage stresses, which may be both tensile and compressive and of all magnitudes up to the yield point. During the stress-relieving operation, the temperature is raised uniformly and gradually through a range of about 400 F. This creates no change in grain structure nor any decrease in yield strength, yet it will be found that shrinkage stresses have been, to some extent, reduced. Such a phenomenon is called "recovery."

It is a general rule that internal stresses in most materials decrease with a rise in temperature, and this is particularly noticeable in welded structures.† Such release of stresses in the recovery zone is generally inadequate at low temperatures, and so the relieving temperature must be increased to a point approaching (but never exceeding) the critical range. When the temperature has reached 1000 F or higher, practically all shrinkage stresses are relieved and "relaxation" occurs. Relaxation is, briefly and basically, the permitting of the atoms of the metal to resume their equidistant positions, which positions were originally distorted due to temperature stresses.

Secondary Benefits

In addition to recovery and relaxation, there are usually three other secondary effects of stress relieving: (*a*) "tempering," which removes any "hard" zones and which occurs when a steel is raised to a temperature near its critical range and then quenched (the quenching of the affected areas occurs during the rapid cooling of the heat zones close to the weld); (*b*) "recrystallization," which is the absorption of older crystals with slip lines by the formation of new crystals without slip lines and free of internal stress, and (*c*) "spheroidizing" or the changing of the cementite within the pearlite to small round particles. Since these give the least interference to slip along the slip planes, spheroidizing thus tends to make for a more homogeneous structure between the parent and weld metals.

Photomicrographs Show Effects

All three of these results are illustrated in the accompanying macrographs, Figs. 1 and 2, and in the photomicrographs. Figs. 3, 4, 5 and 6 are photomicrographs taken from various areas on the as-welded sample

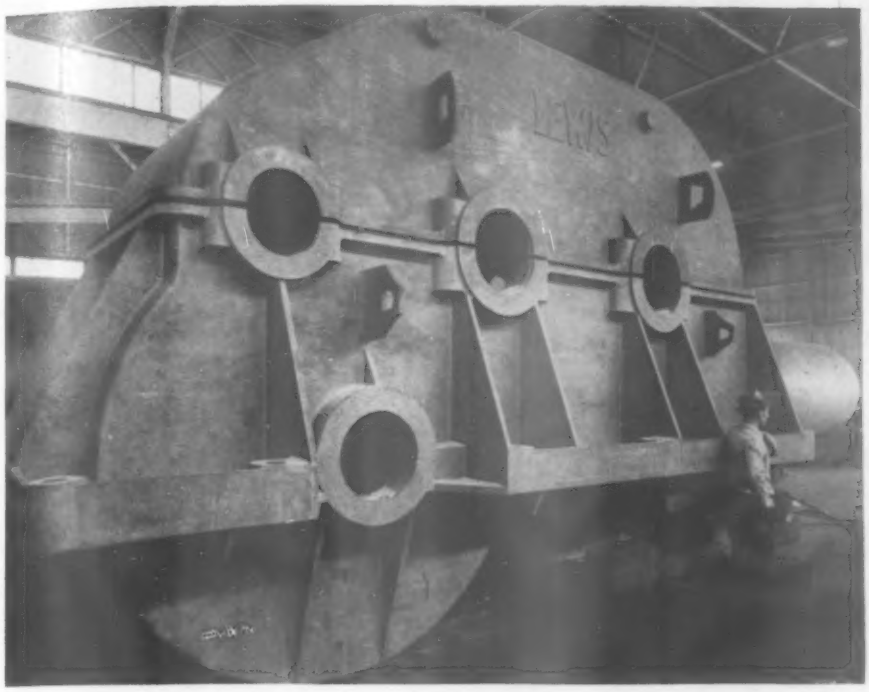
Fig. 6—Parent metal (Cross 56 in Fig. 1). This point was not recrystallized by the heat of the weld since the temperature was below 840 F during welding. Magnification, 100 X.

(Fig. 1), while Figs. 7 and 8 show areas on the stress-relieved sample (Fig. 2).

Though the value of stress relieving is unquestionable, it is also true, unfortunately, that many of its benefits are intangible. As has been previously stated, there is no practical method, short of destruction, of satisfactorily

* The American Welding Society defines stress relieving as "the uniform heating of a structure or portion thereof to a sufficient temperature below the critical range to relieve the major portion of the residual stresses, followed by uniform cooling."

† Since the magnetic and electrical properties of steel also change with a rise in temperature, there is evidently some relation between recovery and atomic and electronic movements.



Another welded product which could not be satisfactorily fabricated without stress relieving is this 61,150 lb mill-drive case and cover. The case measures 20 ft by 9 ft by 8 ft 8 in.; the cover 17 ft 6 in. by 6 ft 7 in. by 5 ft. The upper bearings and caps were flame-cut from 7 in. hot-rolled plate; the main bearing (the one shown below) from 8 in. plate.

evaluating residual stresses. Even if such stresses were accurately known, their seriousness, in a given structure, depends largely upon the conditions encountered in actual service, which, obviously, cannot always be accurately predicted. The higher the locked-up stresses in a structure, the more obvious is the value of stress relieving since such a procedure substantially eliminates such stresses whether they be due to faulty design, poor materials, improper workmanship, failure to follow proper welding sequence or any other reason or combination of reasons.

Test Conditions—Ideal

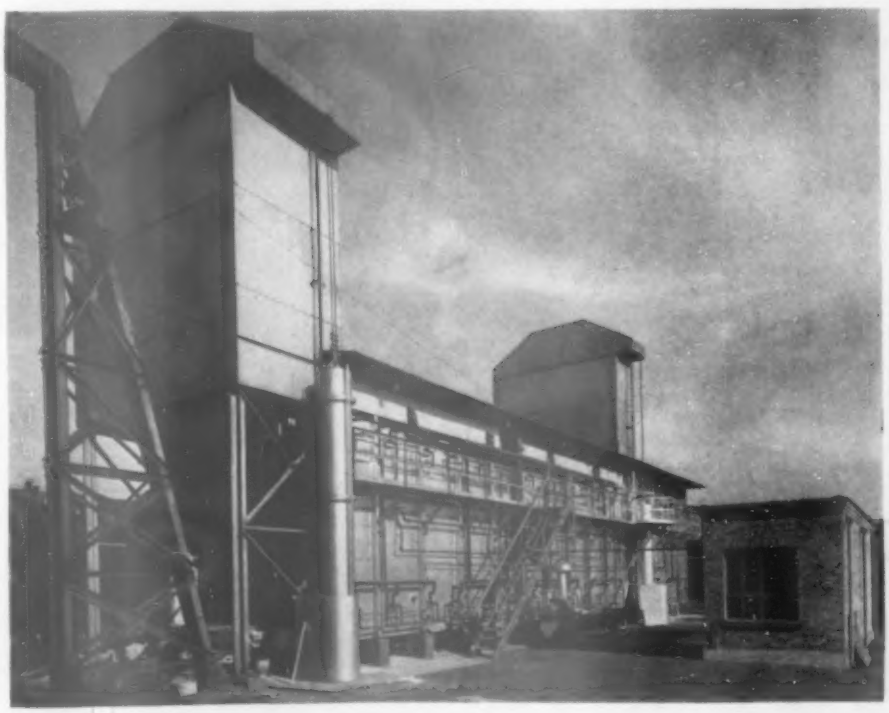
When illustrating the value of any process, it is common and a legitimate practice to base the substantiating evidence on extreme conditions which tend to show up the results to the best advantage. Such a procedure, however, would be difficult to follow when comparing as-welded and stress-relieved samples. To do so would involve the fabrication of two structures as nearly identical as is humanly possible with regard to materials, fabrication procedure, welding sequence and all other factors in order to assure that both would have substantially the same residual stresses. Both structures, after one had been stress relieved, would then have to be put under parallel service conditions and maintained so for a considerable period of time under constant supervision to assure equal treatment. Finally, both structures would have to be destroyed in order to obtain representative samples for test and observation. Such a procedure would obviously be lengthy as well as expensive, and, even if carried out as described, there would always remain the factor of reasonable doubt as to whether the two sets of samples were truly representative and had been either initially or in actual service under the same stresses and operating conditions.

Test Conditions—Laboratory

The as-welded and stress-relieved samples pictured herewith were tested under laboratory conditions. The depicted results were made by an independent outside laboratory. The test plate was an ordinary 1 in. mild steel plate, 24 by 16 in. After welding, test plates of ½ in. thickness were cut off, and alternate samples were stress relieved. This greatly simplified the procedure since the cutting of samples from the same test plate gave positive assurance that both the as-welded and stress-relieved samples had received the same treatment.

On the debit side, a welded test plate is stressed only in a single direction; this condition seldom exists with steel under actual working conditions since in most structures the steel carries the load in larger masses of three dimensions. Furthermore, the welding of the test plate was by the automatic submerged melt process under favorable conditions so that the weld is a more ideal one than would be ordinarily encountered in commercially welded structures. It should, therefore, be recognized that the contrast between the as-welded and stress-relieved samples is not nearly as great as it would have been if the weld had not been of extremely high quality and if the inherent stress had been greater.

This large furnace is suitable for stress relieving welded pressure vessels or other structures up to 15 by 15 by 80 ft in size.



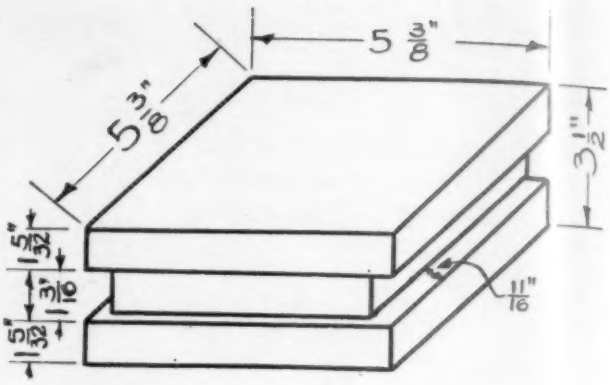


Fig. 1—A square turret is flame-cut to these dimensions from a piece of 3½ in. plate.

Flame-Cutting Square Turrets

A machine tool maker selects machine flame-cutting as a means of reducing machining cost. This choice results in a $35 saving on each square turret tool post.

By **H. F. BERG,**
DeBourgh Mfg. Co., Minneapolis

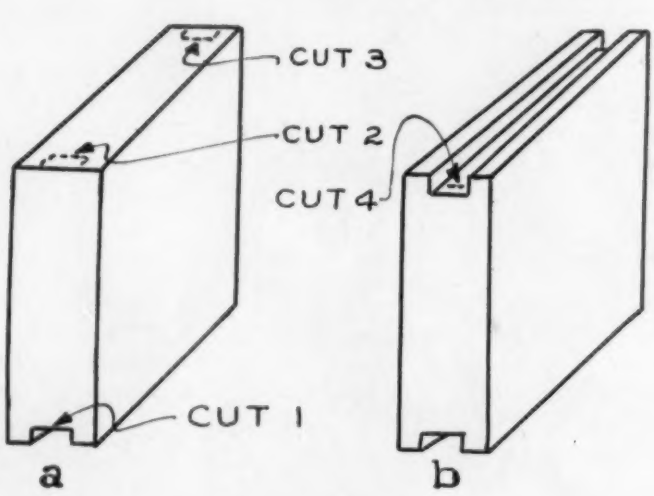


Fig. 2—The groove cutting sequence: Cut 1 is made with the 3½ in. block standing on one edge, after which it is rotated 90 deg for the making of cuts 2 and 3 (a). The final cut, 4, is made after the block has again been rotated 90 deg (b).

A COMPARATIVELY simple flame-cutting application is replacing a machine operation for a machine tool builder, resulting in a saving of $35 on each square turret tool post required for a turret lathe.

This job, like many others, had always been classified in the category of those which could be done only by hours of costly machine work. Industrial demands, however, made it imperative that this viewpoint be revised. Production had to be increased—and quickly. While a similar job had never been undertaken by machine flame-cutting, officials of the DeBourgh Mfg. Co., Minneapolis, could see no reason why it could not be successfully accomplished.

Cutting and Grooving

The job was that of doing the rough machine work necessary to produce a square turret capable of holding four cutting bits. Essentially, the task was to cut a square 5⅜ in. by 5⅜ in. from a steel slab 3½ in. thick and to groove the four 3½ in. sides to form a recess 1 5/16 in. wide and 11/16 in. deep midway between the top and bottom surfaces (Fig. 1).

The flame-cutting of the 5⅜ in. square block presented no problem. A multiple flame-cutting machine made it possible to cut out three of these blocks at a time. The forming of the grooves in the four sides was somewhat more difficult. Since the block was placed on its side when the grooving was undertaken, the operation involved the flame-cutting of steel 5⅜ in. thick.

After the first cut was made, the block was turned sidewise 90 deg for making cuts 2 and 3 on opposite sides as pictured in Fig. 2a. This presented no problem other than that of thickness since the cutting torch was guided by a magnetic tracer following a steel template—exactly the same arrangement as was used to cut the square blocks from the slab. A real problem arose, however, after three sides had been grooved.

A Complex Cut

The fourth cut (Fig. 2b) was at first made in a manner similar to that followed in making the first three cuts. This cut was much more difficult, however. Cutting was started with the torch tip at a normal distance from the steel, but after the tip had traveled inward about 11/16 inches, the direction of torch travel was changed 90 deg. The surface to be flame-cut immediately dropped 11/16 in. beyond the normal tip distance. This sudden drop resulted in somewhat less efficient cutting because the tip was considerably beyond the normal working distance from the work.

As the cutting torch advanced toward the edge of the groove, the tip again approached normal operating conditions. When the edge of the groove was reached, the direction of the cut was changed once more in order to complete the cutting operation. This "coming out of the groove" proved to be a difficult task. There was always a tendency to overcut at the beginning of this change of direction as shown in Fig. 3.

Naturally, this failure to hold the desired contour was unsatisfactory, but what was to be done about it? What was the cause, and how could it be avoided? The cause, it was finally determined, was not simple but complex. It was attributed to a combination of circumstances—the preheat which had been built up in the steel by the cutting flame and the cutting conditions developed by the differences in surface elevations caused by the previously cut groove.

The Solution

Both of these difficulties were overcome by experiment. The solution is as shown in Fig. 4. The cut was started as previously indicated and a change in direction made when the desired depth inward had been reached. Both of these actions were automa-

tically controlled, of course, since the torch was being guided by a magnetic tracer. When the flame had cleared the edge of the groove, upon reaching the desired depth it started across

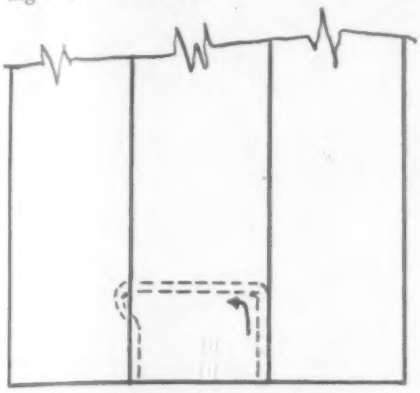


Fig. 3—Difficulties were experienced with cut 4 because of a tendency to overcut.

the groove with a magnetic tracer guiding the tip. At the point about midway across the groove (previously cut in a side but now on the top of block), the magnetic tracer was made inoperative, and the tip was manually guided outwardly towards the edge of the steel block.

As the edge of the block was reached, the direction of cutting was again changed. A "skinning" cut was now taken along the edge merely to hold the flame and the preheat. This manual cut was continued along the edge until the magnetic tracer again came in contact with the template. During the period of manual guidance, the direction of rotation of the tracer drive motor was changed so that the tracer, when it came into contact with the template, began to move the torch in a direction opposite to its previous direction of travel in order to complete the cut. The procedure eliminated all difficulties experienced from the tendency to "overcut" at the corner.

These several flame-cutting operations constituted the major portion of the "machining" required on these tool posts. The flame-cutting was sufficiently accurate and held to close enough tolerance so that a single finishing tool capable of machining all five surfaces of a side at once could be used to clean up the sides and bring the square turret to finished dimensions.

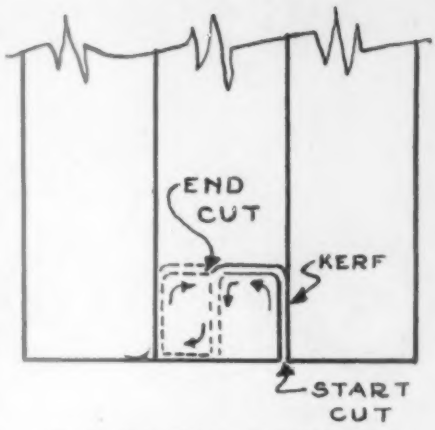


Fig. 4—Overcutting was avoided by the adoption of this cutting procedure.

After the sides had been machined, the center hole for the tool post bolt was drilled, and holes along each edge were drilled and tapped for set screws for securing the tool holders. The finished product—one that has been made quicker and at a lower cost, thanks to flame-cutting—was then installed on a lathe to perform its part in war production.

★

Making a Safe Car for the President

By **FRED B. BARTON**
War Correspondent

Armored sedan used by President Roosevelt at the Cairo conference. The men in the picture are Ordnance Lieutenant L. L. Wilkinson of Gulfport, Miss., and Corporal, T/5, Fred Beers of Jeannette, Pa.

Courtesy, The Lincoln Electric Co.

BY ARC WELDING armor plating on a 1937 Packard sedan, the President of the United States was given a bulletproof vehicle in which to ride through the streets of Cairo during the three weeks in which he conferred with Prime Minister Winston Churchill. The Cairo conference was held last November, immediately before the famous Roosevelt- Churchill-Stalin confab at Teheran.

Ordnance Lieutenant L. L. Wilkinson, technical director of a base automotive maintenance installation stationed on the edge of the desert near the Egyptian capital, tells the story:

"Secret Service asked for the job in a hurry. We could not have more than four days — three would suit them even better. The car was standard U. S. Army style and color. We didn't touch the outside a bit — it didn't need any distinguishing marks —nor did we touch the driver's seat. From the partition on back, however, we ripped out upholstery, cushions and even the window glass and went to work.

"We had no pattern to work by, but we did have a definite idea of what was wanted. Protection. That meant shielding the cab from any chance bullet from side or top or back or from an explosion from the bottom. We made our patterns out of paper first and then plywood, cut armor plate to fit and stitched it in. It was a day-and-night job. During those three days, we kept our welder running 18 hours a day."

The weldors finished their job on time—and a bit ahead. To supplement Lieutenant Wilkinson's account, the armor plating was the stuff developed at Rock Island Arsenal to protect the noses of P-38 and P-40 pursuit planes from bullets. Extra spring leaves had to be built to support the many hundred pounds of extra weight.

The rear window was sealed over, and the front and side windows were covered with tight-fitting chunks of bulletproof glass; since the windows could not be opened, a small blower was built in to keep the air circulating. The sturdy iron brackets supporting the heavy glass could not be concealed, but no one complained about the looks of the job, though the President did refer to the car as "the County Jail."

After its famous occupant had left for Teheran, the car was abandoned in an Army parking lot at Camp Huckstep, outside of Cairo. It would not last long if driven over the roads with its added weight, nor was it worth the Army's while to tear out the welded armor plating with cutting torches and rebuild the inside. Perhaps the engine may be eventually disassembled, and its vital parts used for making other military cars new.

The Welding Engineer—What's His Job?

★Part Two—Though the welding engineer's job may vary in different organizations, certain basic responsibilities are more or less common to all manufacturing plants. Mr. Brooking analyzes these common factors in detail in his three-part series on arc-welding engineering problems.

By **WALTER J. BROOKING**
Director of Testing & Research,
R. G. LeTourneau, Inc.

There are at least ten basic welding engineering functions which must be performed by someone if the welding department is to operate efficiently. In February Mr. Brooking took up the first, the selection of processes and equipment. Functions Nos. 2, 3, 4, 5 and 6 are discussed here, while the concluding installment will cover the remaining four—the establishment of general welding procedures, the establishment of a production control, the establishment of a quality control and the engineer's need to keep abreast of new practices and processes.

II. Evaluating Welding Electrodes

CAREFUL study and evaluation of electrodes presents a very important field for objective and detailed study by the welding engineer. Obviously, the electrodes must be selected for the type of material being welded, and they must also operate to the best advantage with the welding equipment and the operator skill which are present in the organization. These two requirements, however, are by no means the only ones to be considered.

Sometimes special physical requirements must be met for mass-production welding. The electrodes may be tested for these requirements by outside control agencies, but someone in the organization must understand the testing procedure and be able to make use of the data which is thus experimentally obtained.

Another important consideration is to select the electrodes that are best adapted to the positions in which welding is ordinarily done in the plant; E-6020 electrodes, for example, for downhand welding (on ordinary low-carbon steel) and E-6010 or E-6012 electrodes for horizontal, vertical or overhead positions.

Special types of electrodes, such as hard-facing or high tensile electrodes, will necessitate special engineering studies in order to obtain the maximum possible economy.

Comparative testing of electrodes within a certain type—*i. e.,* the comparison of all Class E-6010 electrodes produced by different manufacturers—constitutes yet another task for the welding engineer. Controlled, scientific measurements such as pictured in Fig. 5, where stop watch and ammeter are employed, may represent an important source of welding economy.

Electrode selection and evaluation always has two phases. The first phase is that of operating characteristics—ease of handling, speed of deposition, ease of slagging, etc.—as seen from the weldor's viewpoint. The second phase is that of economic advantage and involves the original price of the electrode, the percentage of it deposited, the actual cost of the finished unit of welding as affected by the particular electrode being studied. Such data, obviously more difficult to secure than ordinary operating information, cannot be obtained without careful engineering research.

Fig. 5—Electrode comparison tests must be carefully controlled by the stop watch, rule, ammeter and weighing balance.

Testing and Re-testing

The testing of electrodes cannot be done once and then forgotten. Periodic re-examination and re-testing are required in order that the organization may be assured that it is at all times following the best practices and using the electrodes which are best

Fig. 6—The training of new welding operators or adaptation of the skills of previously trained weldors is an important function of the welding engineering organization.

adapted to the particular type of production. Whether the testing is done by a welding engineer, a testing and research department, a production foreman or an outside organization, a scientifically established procedure must always be followed.

III. Testing Weldors

The testing and qualification of weldors seeking employment is another function of the welding engineering work in a manufacturing plant. Each individual plant will probably have different requirements for welding operators, but someone in the plant must be able to evaluate the skill of the weldor who applies for work in terms of the plant's particular requirements.

The qualification test is the best means of objectively evaluating a weldor's skill, and the administration of such tests before applicants are hired is the best method of avoiding future disappointment. These tests need not be complicated nor costly. However, they should be specific to the general needs of the organization and should consist of the same sequence of operations (conducted in an orderly and consistent manner) for each new man tested.

IV. Training New Weldors

After new employees have been hired, there is a definite training program to be carried out. Its purpose may be either to train a man who knows nothing about welding or to adapt the skill and knowledge of a previously trained weldor, but there must always be some kind of training.

Among the most desirable objectives of training are the establishment of good welding habits and the speedy education of the new man in the use of the particular types of electrodes, types of fixtures and other special details which make work in the plant different from that of other welding organizations.

The maintaining of a "school" (if only a small localized department in the welding shop) for the polishing off and special detail education of incoming weldors has been found to be a very practical means of getting the new man started. Such a school for new weldors is pictured in Fig. 6.

Many organizations find it advisable to provide a welding instructor to assist the new man on his first job (or to assist older men when they are shifted to a new operation). This type of specific instructional supervision gives special training on the job and prevents the development of bad habits with regard to weld sizes, location of welds, weld sequences and step-by-step procedures. When the new man has been firmly established in his job, he may be safely left to the less detailed attention of the departmental supervisor.

Emphasis on safety in the handling of electrodes and machines should be made an important part of the new man's training. A proper understanding of safety regulations will help to avoid injuries and reduce the possibility of damage to machines and equipment. Machines, it should be noted, can be damaged even during the hours when they are not being used; *i. e.*, a welding machine, if left turned on and grounded by the lead, is likely to overheat and damage or destroy itself or other parts of the equipment. This phase of education lends itself profitably to the orderly and scientific approach of the engineering method.

V. Correlating Plant Departments

The design of welded equipment is, of course, a function of the engineering department but not necessarily of that department alone. Often, the special knowledge of several departments must be pooled in order to produce the best design.

Important to the design and production of parts for welding, for instance, is the knowledge of the capacities of all machines in the plant: shears for cutting parts from plates, the overall capacity of flame-cutting units, capacity of bending brakes, rolls or presses. All of this information should have a distinct bearing upon product design.

The relationship of the volume of weld metal to increase in the lineal dimension of the weld is information which should be known by both

Fig. 7—The total web sections in "A" and "B" are equal in strength, but only one-half of the weld metal is needed to fuse the two 5/8 in. sections. Design "B" is equally economical with regard to welding time and power costs.

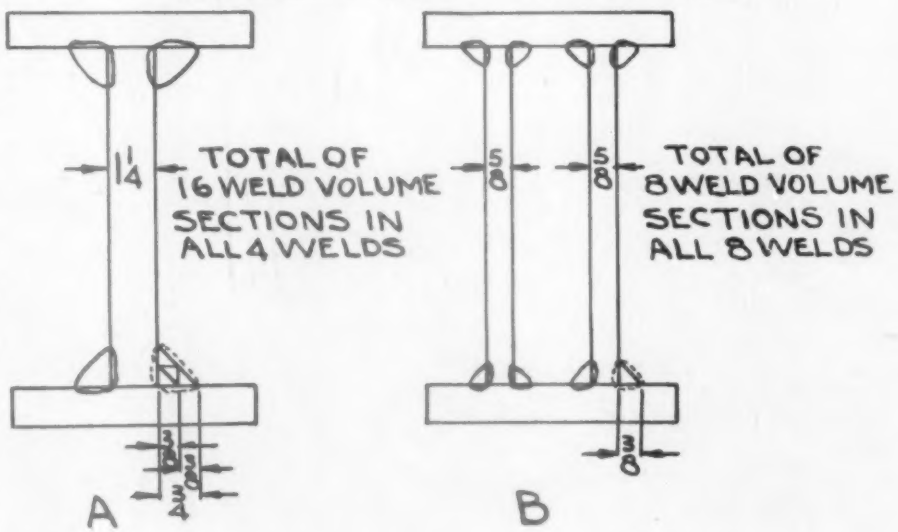


Fig. 8—It is sometimes more economical to use the bending brake to bend one flat plate into a right angle than to weld two plates together.

the manufacturing departments and the designing engineers. Note that in Fig. 7 the web sections of "A" and "B" are equivalent in strength, yet "B" requires only one half the amount of weld metal. Information such as this is distinctly significant to both welding design and welding production practice. For example, it may be that the available machinery will handle the plates equal to half the total strength required but won't handle a solid plate equal to the full strength or that the additional work involved in making two of the thinner pieces may actually cost less than the deposition of the double quantity of weld metal required by the single thick piece.

The use of the bending brake (see Fig. 8) to reduce welding is another general principle which should be widely understood. Use of this machine may often result in simplification of design and produce real economy in mass-production operation.

Another fundamental consideration is the determination and control of the correct size of welds. In joints of the "T" or fillet types, the legs of the weld may easily extend to almost any degree to which the operator wishes to deposit metal. But linear increases in the size of the weld on fillet joints will result in increases in the amount of weld metal (and cost) by the square. Thus if the size of a weld is increased by only one half, well over twice the amounts of time, power and weld metal are required to weld the joints. $(150\%)^2=225\%$.

The knowledge of these fundamentals on the part of the organization in general tends to lead to more economical welding engineering inasmuch as it enables designs to be made that will cost less or changes to be made that will reduce the cost of welding without reduction in quality or strength of the unit.

The weldability of different materials and the relationship of the welding process to the chemical composition and metallurgical properties of the materials in the structure also affect more than one department; *i. e.*, members of the organization who are engaged in design, cutting, shaping, heat treating, machining and other processing.

VI. Fixtures for Welding

Each separate welded structure should be studied individually with the objects of: (1) aligning the parts more quickly, accurately and efficiently and (2) positioning the unit for welding in the most favorable and economical position. Under this heading should be included the possibility of premachining the parts prior to alignment and welding, as shown in Fig. 9; this is a phase of welding engineering which can be lucratively studied.

The effects of welding heat, including the resultant distortion and locked-up stresses, must also be studied in connection with the design of the most efficient fixtures for welding production.

Structures may often be fabricated as several subassemblies in order to achieve more favorable positioning during the welding process or in order to reduce handling and/or increase the ease of machining those parts which cannot be machined prior to welding. All of these possibilities must be considered.

The use of the time study method is one of the best means known to discover the differences in cost between downhand welding and horizontal fillet welding or between fillet welding and vertical welding or overhead welding, etc. A time study definitely establishes the amount of added efficiency which can be achieved by positioning welds for downhand or other more favorable welding. It is commonly found that from 25 to 50% can be saved in both the time and cost of welding by the use of the proper positioning fixture.

Part Three, which discusses the remaining four of the ten basic welding engineering functions, will appear in an early issue of The Welding Engineer.

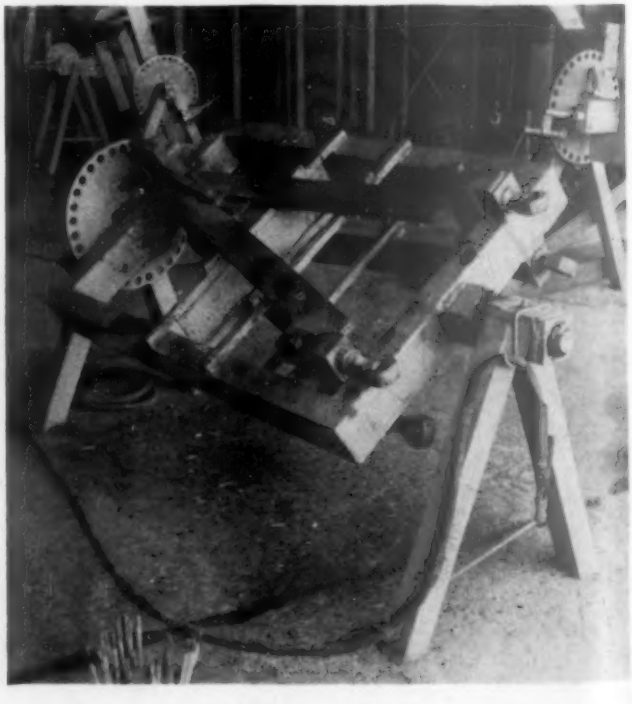
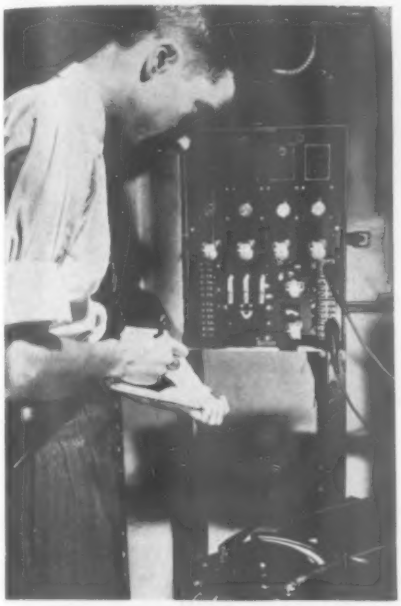


Fig. 9—The building of fixtures which speed up and simplify alignment and welding operations is an important welding engineering function. Note the use of premachined parts in this structure and how the fixture protects these parts from weld spatter drops.

★ OPERATIONS

Tips on Trouble Shooting Electronic Controls



Electronic control equipment being checked for line voltage, which should correspond to within plus or minus 5% of the panel nameplate rating. While the electrician makes this check, he should familiarize himself with the voltages that exist between various points on the panel since this information may be of great value to him in helping to locate the sources of future troubles.

Many shop men seem to regard electronic control panels as mysterious and awesome objects which are not to be touched by the profane hand of the uninitiated. Let's start thinking of them as practical production equipment that must be kept in tip-top operating condition.

By **W. D. COCKRELL**
Engineer,* General Electric Co.

ELECTRONIC equipment, generally, requires less maintenance than other electric equipment since it has no moving nor wearing parts. Nevertheless, it is essential that certain maintenance procedures and checks be followed in order to keep electronic control devices in top-notch operating condition and to prevent production interruptions. To help in locating and remedying troubles as quickly as possible, this article presents a highlight discussion of good maintenance trouble-finding and trouble-correcting practices.

Of the eight basic members of the electronic tube family, as many as five may be employed to control resistance welding. In one type of control panel for spot, pulsation and seam welding, there are five kinds of tubes—ignitrons, phanotrons, thyratrons, kenotrons and glow tubes—with these functions:

Ignitrons: to control the heavy alternating current used in resistance welding.

Phanotrons: to furnish d-c for the grid bias of the thyratrons.

Thyratrons: to control the starting of the ignitron current; to time the number of cycles the current is on and the number it is off.

Kenotrons: to rectify the control impulses so they can be counted by a thyratron (several impulses make up each weld).

Glow tubes: to regulate the timing voltages.

Semipermanent, Frictionless

Most of the components of electronic controls — resistors, reactors, transformers and capacitors—are of a semipermanent nature and will give many years of service with very little maintenance. The electronic tubes themselves are replaceable, but even these require inspection and testing only at comparatively long intervals. In view of these facts (and because electronic control will sometimes continue to function under extreme conditions of moisture, temperature and dirt), there is frequently a tendency to neglect the simple rules of good maintenance.

The first rule is to remember that many parts of electronic controls are similar to those used in magnetic controls. Enclosing cases, bases, terminals, wiring and conduit devices are frequently identical. Standard magnetic control devices — fuses, switches, overload relays of both the instantaneous and the time delay types—are found on many electronic panels. These devices, performing starting or protective functions, usually operate infrequently. As with standard magnetic control panels, the infrequent operation in itself will sometimes result in special maintenance problems. Detailed instructions as to the inspection and maintenance of these standard devices are beyond the scope of this article; such instructions may be found in maintenance manuals covering this equipment.

Preventive Maintenance

Particular emphasis should be placed on inspection for *cleanliness* and the *effects of vibration*. Because of the high impedances used in some electronic circuits, an excessive accumulation of dust will (particularly when damp) provide parasite circuits which may interfere with proper operation.

Excessive vibration is apt to have many troublesome effects. Since many electronic panels are interconnected extensively with other apparatus, the loosening of connections or the breakage of leads through vibration may cause serious shutdowns. Intensive (and sometimes aggravating) "trouble shooting" is often entailed before the fault can be located. Furthermore, vibration tends to shorten tube life. "Preventive maintenance" is, therefore, called for if severe vibration is found to exist at the installation location. In this case, shock mounting of the control panels and/or the use of stranded or extra-flexible leads may be justified.

*Electronics Section, Industrial Control Division.

This electronic panel being subject to slight vibrations (not sufficient to require shock mounting), a periodic check is made to assure that all of the screws and bolts are tight.

Electronic controls involving mechanical components should be checked frequently to assure that the mechanical adjustments have not been disturbed. Common causes of such disturbances are bolts loosening under vibration, chain hoists or other shop equipment hitting against the equipment, etc.

Tube Failure

Very rarely does a modern electronic tube fail suddenly. The failure usually is the result of a gradual loss of emission that takes place as the active cathode material is used up or flakes off. The life of an electronic tube can be materially shortened by overloading, mechanical abuse, operation at high or low filament or cathode heater voltage and operation outside of the required temperature limits.

Among the most prevalent causes of short tube life are the operation of electronic panels on line voltages which differ too greatly (more than ± 5%) from the panel rating and the use of the wrong tap when a tapped-input transformer is provided. If the line voltage at the installation point is consistently high or low, a small auto- or booster-transformer may be used. If the line voltage fluctuates widely, a special voltage-regulating transformer may be required. Faulty heater transformers, loose connections and corroded socket connections should also be watched for—any of these may limit the low-voltage, high-current power which is required for the tube's cathode heater.

Temperature Regulations

High vacuum tubes and tubes filled with true gases such as argon and xenon may be operated without difficulty over a wide ambient-temperature range, but tubes using mercury vapor operate best in a more restricted ambient range. Mercury-vapor-tubes include, of course, the ignitron so important in resistance welding.

Enclosing-case ventilation and other temperature-regulating means are provided for the usual industrial indoor ambient temperatures of 60 to 100 F. For lower ambient temperatures, manually or thermostatically controlled strip heaters may be mounted in the case. For temperatures from 100 to 120 F, fan or forced-air cooling may be sufficient.† Above 120 F, the problem of cooling should be considered carefully since components other than the tubes may be affected by this high ambient temperature.

A cathode protective timer is normal equipment for panels which use gas- or mercury-filled tubes. This timer should be set for the heating period designated by the instructions accompanying each new tube. The time thus designated has been found through experience to be the minimum permissible for reasonable tube life, and it must not be decreased for any reason.

Mercury-Vapor Tubes

Mercury-vapor tubes must be kept upright as much as possible in order to keep the mercury off their elements. During shipment, however, some liquid mercury may be splashed on the elements. It is necessary to distill off the splashed mercury before the anode power is applied; this is done when the tube is first placed in service by heating the tube cathode with the anode lead disconnected. The heating time requires a longer period than the usual cathode heating time; the proper time is given in the tube instructions.

Overloading seriously reduces tube life. It is essential that the external loads be no greater than either the average or peak rating of the tubes. Practices such as increasing the anode voltage, replacing coils or altering motor pulleys or gearing to obtain a greater output should be avoided.

Don't Drop Tubes!

Shocks and jars can be quite detrimental to electronic tubes, particularly when they are old. Sharp shocks, such as caused by dropping or striking the tube, may not actually rupture the envelope (which would be noticeable at once) but may jar the elements out of position or even break welds or leads. A tube subjected to such a shock should always be carefully inspected immediately.

†Ignitron tubes are designed with a shell which provides water cooling. *The Editors.*

Tubes in electronic control apparatus should be checked at regular intervals in the tube tester. It is recommended that a spare set be kept handy at all times so that any defective tubes may be promptly replaced.

Trouble-Shooting Tools

The best of all trouble-shooting tools is a clear knowledge of the operation of the panel and each part of it. Physical instruments, however, are also necessary.

Since many circuits on electronic panels have a very high impedance, meters having high impedances are very desirable in servicing the equipment. Another useful tool is the radio service multimeter, which has a resistance of 1,000 ohms per volt or higher. For some circuits, an electronic meter, such as a vacuum-tube voltmeter of the d-c reading type or a cathode-ray oscilloscope, is essential. The cathode-ray oscilloscope (particularly when modified to read d-c potentials) is an extremely useful device since it combines a very high impedance voltmeter with a time axis, thus making visible voltage changes which are much too rapid for the ordinary meter to follow. Instantaneous thyratron grid and plate potentials and other voltage wave forms may be observed easily on the oscilloscope and any incorrect operation quickly detected.

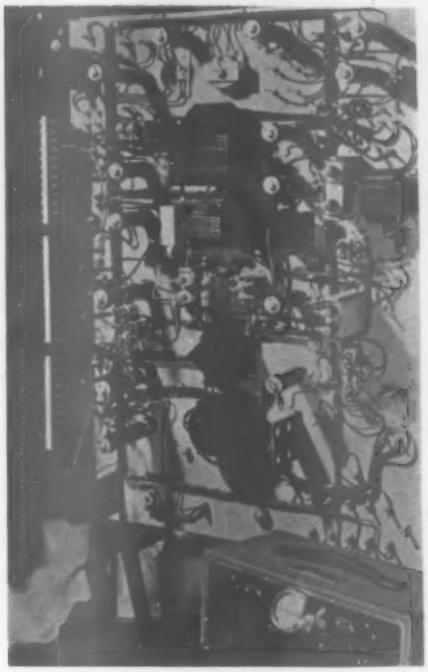
In trouble shooting electronic controls, one should first make sure that the trouble actually does lie in the electronic equipment and not elsewhere. Here are test check-questions: Is power available at the control panel terminals? Can the motor or other device be operated by alternate means (such as from a d-c bus by drum switch or magnetic control) if provided? Are all protective devices and interlocks outside of the panel operating properly? Has the cathode protective timer relay completed its timing cycle and applied anode power? Have mechanical adjustments been disturbed where items with mechanical components are used?

The time at which the failure occurs is important in making a diagnosis. Three times-of-failure should be considered separately: (1) when first starting new equipment, (2) when starting after a normal shutdown and (3) during operation.

Failure to Start

When new electronic equipment fails to start, the cause may be a lack of correct power, incorrect or missing connections, tubes in wrong sockets, use of wrong or defective tubes, no fuses or wrong-size fuses, damage done to panel leads or parts in shipment.

Incoming power should be checked against the panel nameplate. The position and type of tubes can be checked by referring to the wiring diagram and the panel stamping. Defective tubes and (sometimes) tubes in the wrong socket may not heat up. The glow of the hot cathode may usually be seen in a glass tube, and the envelope of a metal tube becomes hot to the touch. (*Note:* the envelopes of metal thyratrons and ignitrons are at cathode potential. Do not touch one of these tubes while power is on the panel!)



The cathode-ray oscilloscope is sometimes used for checking the electronic control panel of a resistance welder. This is a most useful instrument for checking wave shapes when searching for electronic circuit faults.

Failure after Shutdown

When electronic equipment does not operate after a normal shutdown, first check the power, then interlocks and safety switches. The cathode heating timer relay may have failed or the anode contactor may be defective. An old tube often fails due to expansion and contraction as power is switched off or on. Filament or heater burnouts may be detected by inspection of glass tubes or by feeling the temperature of the metal tubes. (*Note:* power should always be shut off before touching metal thyratrons and ignitrons.)

Sometimes an overloaded transformer or reactor will fail due to the expansion cycle as power is removed and applied. Here, however, warning of failure is usually given by excessive heating, by the odor of the hot material, by melting of the sealing compound or by smoking or charring of the insulating paper.

Failure during Operation

It is often possible to isolate this trouble to a specific cause by noting the exact symptoms of the failure. Power failure or a blown fuse, for instance, will result in an instantaneous stoppage of operation. With an overloaded transformer, resistor or wire, heat and smoke usually appear before total failure occurs. The cause of overload—short circuit, load coil burnout, motor-bearing failure — must be found and corrected.

A failure in a tube cathode circuit permits the cathode to cool gradually over a period of seconds or even minutes. The loss of operation, therefore, may be gradual rather than sudden as in the case of power failure. However, small rectifier— and battery-operated tubes will cool quickly.

If none of the above causes for failure are evident, it will be necessary to go carefully through the operation of the circuit and to analyze each step. An instruction book for the particular panel, at least an elementary diagram of the circuit, should be available. If the circuit is at all extensive, it is usually possible to simplify it by division into two parts; for example, the control and power circuits of a welding control. It may then be possible to use a meter, electronic voltmeter, cathode ray oscilloscope, etc. to determine whether or not the control section is operating correctly as the input is varied over the normal range. Likewise for the power circuit, a simulated control signal may be applied to test that half.

Each part of a circuit can be further subdivided in a similar manner until the faulty circuit or part is found. With clear knowledge of each part of the circuit, this procedure can be carried out quite rapidly. It is a good idea to anticipate future trouble by checking the operation of panels while they are operating correctly and recording the voltages found and the cathode ray traces seen between specific points. When this has been done, the differences found in a defective panel will be immediately evident, and the trouble shooting will take much less time.

If trouble keeps recurring in certain parts of the circuit, the manufacturer should be notified. Quite often the assistance of the manufacturer's design engineers may be obtained to suggest a cure. Sometimes slight modifications in the equipment may be proposed to provide more desirable characteristics for the particular installation. Complete information from the panel nameplate as well as a description of the part and the trouble found should always be given to the manufacturer so that assistance may be rendered quickly and effectively.

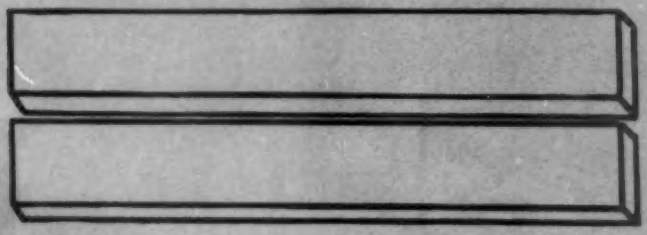


Fig. 1—The test bars as they appeared before welding.

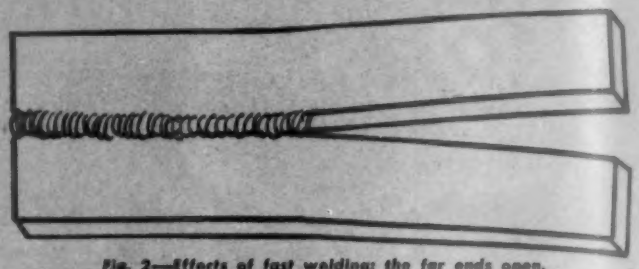


Fig. 2—Effects of fast welding: the far ends open.

Finding the Best Welding

Neither too fast nor too slow: a middle speed is best to avoid warping on butt-welded bars, the author discovered.

THE WRITER recently conducted an interesting series of experiments to determine the effects of various welding speeds on warping. These tests were conducted while welding together ⅜ by 1½ in. mild steel bars, cut 12 in. long. Reverse polarity $^{3}/_{16}$ in. electrodes were used.

In all cases, the gap between the two bars was parallel. The bars were not tacked together, nor were they restrained from moving in any way. The weld beads were always begun at the left and proceeded towards the right.

All of the tests were repeated twice, using a much greater heat in the second test than was used for the first series. The amperage used, it is interesting to note, had absolutely no bearing on the results of the experiments.

Fast and Slow Welding

Fig. 1 shows the two steel bars as they were laid on the welding bench. In the first experiment, I started at the left end and welded as fast as I could. As I proceeded, I could see the two plates moving further and further apart, until a point was reached where I could no longer fuse both pieces of metal with one bead (Fig. 2).

Fig. 3 illustrates the effect produced by welding slowly. I started at the left, as before, and welded as slowly as I could. As soon as the arc was broken, the ends of the plate came together. The ends quickly separated when I restruck the arc to carry the welding further, but came together again, closer and tighter than before, when the welding was stopped.

I observed that the ends tended to come together every time the welding was stopped and to part again every time the arc started. In addition, I saw that the plates closed furthest and fastest when the weld metal was changing from yellowish red to dull red. From dull red to black, the movement was much less and much slower.

Fig. 4 illustrates the appearance of the plates while the welding was proceeding at a medium pace. The plates did not move at all, nor did the ends open or close when the welding was finished.

Fundamental Considerations

An analysis of these experiments reveals some of the reasons why warping appears in butt welds.

In Fig. 5 is diagrammed the movement of heated areas, with their corresponding expansions and contractions, as they occur in all forms of welding. The weld metal, having been deposited at its highest temperature, is contracting at all times. Until cooling is completed, however, the weld metal is hotter than the base metal. As a result, heat is conducted from it (and from the arc) into the base metal.

In the area in which heat is radiating from the weld metal into the base metal, the latter is expanding. This area is marked "A" and is indicated by the striped lines.

Immediately behind area "A," at any moment of time, is a hot area which has ceased to expand but has not yet begun to contract. This area (left clear on the diagrams) is labeled "C."

Behind "C" is an area in which all the heat from the weld metal has been conducted into the base metal. Here both plate and weld metal are cooling, producing an area of contraction. This area is indicated by dots, and it is marked "B." The remaining area, "D," has not yet been perceptibly heated by either the arc or the weld metal.

Why the Ends Open

In Fig. 6 is illustrated the movement of heat occuring when the welding proceeds at the fastest possible rate. Area "A," the area of expansion, in which the heat is being conducted into the base metal, is relatively long because the welding advances so quickly in any moment of time. Since the area of expansion is so long, the open ends do not feel the counteracting effect of the contracting area, "B." Hence the surplus heat causes bending and warping of the base metal, and the ends of the plates are therefore permanently deformed outwardly.

The two areas, "A" and "B," should cancel themselves out, as happens in the case of a medium-speed weld, Fig. 8. But because the area of expansion is so long, the open ends are relatively free from the counteracting area of contraction.

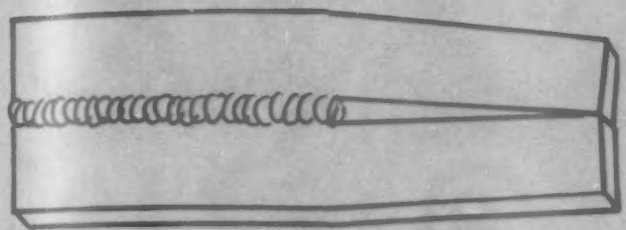


Fig. 3—Effects of slow welding: the ends draw together.

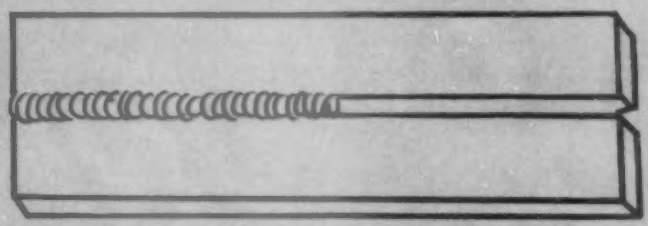


Fig. 4—A medium speed causes no movement in either direction.

Speeds . . .

By JOSEPH SCHUMAN WRIGHT

Why the Ends Close

In Fig. 7 is illustrated the action of the heat in the case where the welding proceeded at a slow pace. It will be observed that the preheated area, "A"—the area of expansion—is not nearly as long, as measured along the welded bead. As a result, the area of contraction, "B," is much closer to the arc than is the case in rapid welding. Being so close to the arc and to the soft weld metal, it exerts a crushing pressure, which carries its effect beyond the expanding metal and affects the base metal as a whole. It is this surplus of contracting area which causes the plates to bend and warp inwardly.

The Middle Way

The ideal welding speed is illustrated in Fig. 8. Here the two areas exert equal forces, the inward pull of the contracting area being counterbalanced by the outward push of the expanding area. As a result, the two stresses are equalized, neutralized and localized. There is no surplus energy to warp the base metal.

This is the ideal speed at which to weld. It varies, of course, depending on the material and other considerations, but a little practice should quickly give the weldor the feel of his proper welding speed.

Let me repeat that the amount of amperage used does not affect this warping action. I performed my first set of experiments using a 400 amp welder set at approximately 200 amp while the second set were made with the machine set at approximately 280 amp. Naturally, the arc was much hotter at the latter setting, yet identical results were secured. In all cases where I welded slowly, the plates pulled together; in all cases where I welded rapidly, the plates separated; and whenever I welded at a medium speed, the plates remained stationary.

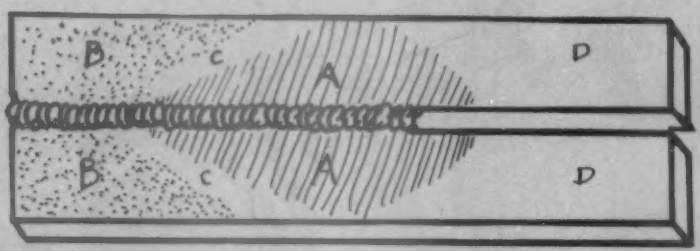


Fig. 5—Heat analysis diagram. A—area of expansion; B—area of contraction; C—hot area in which contraction and expansion are balanced; D—area not yet appreciably heated.

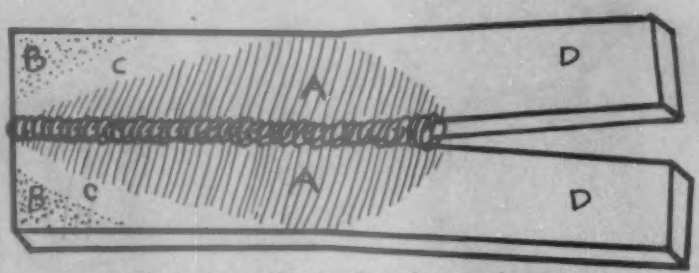


Fig. 6—Fast welding lengthens the area of expansion, "A," and this tends to force the ends apart.

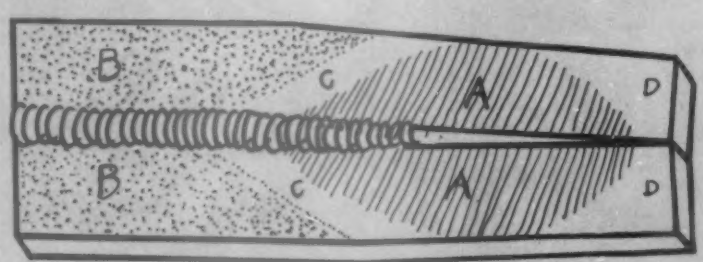


Fig. 7—Slow welding brings the area of contraction, "B," closer to the arc, enabling the contractive forces to push the ends together.

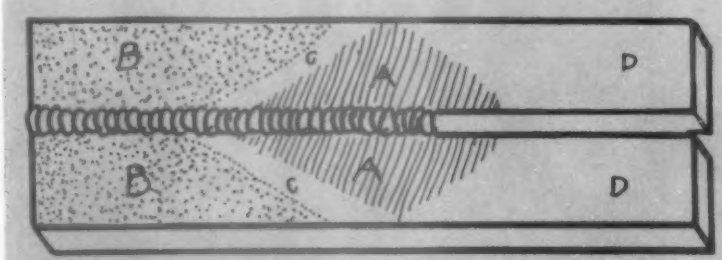


Fig. 8—At medium welding speed, the forces of expansion and contraction are balanced, and for this reason the ends do not move.

Welded Tanks for Penicillin

Many of our men may owe their lives to these containers for quantity production of the new high-powered bacteria killer.

By CLYDE B. CLASON

Right: 20,000 gallon tank for synthetic growth of the penicillin mold; below: a shipment of the 2,500 gallon containers.

PENICILLIN, wonder antiseptic of World War II, was originally made laboriously in containers the size of milk bottles. Now it is on a mass-production basis, thanks to 2,500 and 20,000 gallon welded tanks which permit quantity output in half the former time. For "productive excellence in the manufacture" of these containers, the John Nooter Boiler Works Co., St. Louis, was last month awarded the Army-Navy E.

An Easy Job

Though production of the penicillin containers placed the name of the Nooter Company on the front pages of leading newspapers throughout the country, the men handling this job consider it to be only another order. "They're just tanks," declared one company executive. "Nothing out of the way at all. Now when I think of some of the really tough ones we get here—fabricating 12 ft aluminum vessels, for instance, or welding corrosion-resistant linings of silver clad or stainless....."

In its nearly 50 years of tank manufacture, this St. Louis concern has indeed been called upon to solve some "tough ones." It has pioneered in the welding of difficult alloys and has successfully accomplished feats—such as the overhead welding of a certain nickel-chrome alloy—pronounced impossible by experts.

Penicillin Production

As all the world has now been informed, penicillin is produced from a mold (*penicillus notatum*) which excretes a liquid deadly to bacteria. The mold was originally grown on an organic medium in the laboratory, and important scientific magazines had placed themselves on record as saying it could not be grown in any other way. Even as the authorities spoke, however, a synthetic-growing medium was being found, a mixture of glucose and inorganic salts. All that was now needed for successful mass cultivation of the life-giving mold was an environment in which a constant temperature of 75 F could be held. This was provided by the big welded containers.

Two sizes of tanks are manufactured—a 2,500 gallon tank with a double heating coil inside and a 20,000 gallon tank with a jacket for hot water. The 2,500 gallon tank measures 9 ft 1 in. long by 7 ft 6 in. in diameter and has a shell thickness of $\frac{5}{16}$ in. The 20,000 gallon tank is 26 ft 0 in. long by 12 ft in diameter and has a shell $\frac{7}{16}$ in. thick and a jacket $\frac{5}{16}$ in. thick. The tanks are being delivered to the engineering companies building plants for the big-scale production of penicillin. Up to this time, some 36 tanks have been fabricated for use by some 16 manufacturers of the drug.

Few Welding Problems

Since both sizes are made from ordinary mild steel plate, no particular welding difficulties were encountered. The initial tanks were fabricated entirely by manual arc welding, using coated mild steel electrodes of the E-6010 and E-6012 classes, but a production set-up for automatic welding is being arranged. Neither preheating nor stress relieving are done, and a hydrostatic test is the only test necessary on the finished product.

Six days are required for mold growth on the synthetic medium within the tank, as against the ten or twelve days needed to produce the substance by the old laboratory method. Fluid culture is drawn off at intervals from the bottom of the tank, and the penicillin is removed by acidification with phosphoric acid. The main steps in purifying the product are: (1) decolorization with charcoal and (2) washing with a phosphate buffer solution.

Penicillin is an almost sure cure for gangrene—dread scourge of the battlefield. It uses include all those of the sulfa drugs, and it is said to be more potent than any of them. Thousands of wounded soldiers, sailors and airmen may in future months owe their lives to the welded "hothouses" that are pictured above.

Reduce Replacement Costs

by Hard-Facing with Haynes Stellite Rods

THE life of wearing parts of industrial machines and equipment can in many cases be increased from 2 to 25 times by hard-facing with Haynes Stellite rods.

Hard-Face All Parts—Old and New

Old parts which are badly worn can often be reclaimed and armored against wear by applying Haynes Stellite rods. To assure maximum savings, it usually pays to hard-face new parts—*before* wear occurs. Then when long use finally does impair their efficiency, most parts can be hard-faced again and again for added service.

Other Advantages of Hard-Facing

The use of Haynes Stellite hard-facing materials frequently permits use of cheaper base metals—or makes possible the use of a readily available substitute base metal when the usual kind cannot be obtained. When cutting or scraping edges are hard-faced, they stay sharp longer, often reducing power consumption. Time out for repairs is cut down by hard-facing, and this helps maintain high production schedules. At the same time, hard-facing decreases maintenance work and solves many replacement problems.

Wherever abrasion . . . impact . . . heat . . . or corrosion . . . are encountered, there's a Haynes Stellite rod to furnish lasting protection. Write for a descriptive price list.

A Rod for Every Purpose

STELLITE ROD — the original non-ferrous cobalt-chromium-tungsten hard-facing alloy —now available in three different grades— high in "red hardness," highly resistant to abrasion and corrosion—applied by oxy-acetylene or electric-arc process.

HASCROME ROD—iron-base hard-facing rod containing chromium and manganese — work-hardens under impact — applied by oxy-acetylene or electric-arc process.

STELLITE "93" ROD — iron-base hard-facing alloy containing more than 40 per cent of alloy ingredients — hard and abrasion-resistant — applied by oxy-acetylene or electric-arc process.

HAYSTELLITE INSERTS—cast tungsten carbide in 13 standard shapes and sizes—extremely resistant to abrasion—generally applied by oxy-acetylene process with high-strength steel rod as binder.

HAYSTELLITE TUBE ROD—tungsten carbide grains of 9 standard screen sizes in high-strength steel tubes—extremely wear-resistant—applied as hard-facing rod, generally by oxy-acetylene process.

HAYSTELLITE COMPOSITE ROD—tungsten carbide grains of 4 standard screen sizes uniformly distributed in high-strength steel binder — extremely wear-resistant — applied as hard-facing rod, generally by oxy-acetylene process.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

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HARD-FACING RODS FOR EVERY PURPOSE

"Stellite," "Haystellite" and "Hascrome" are registered trade-marks of Haynes Stellite Company.

Short Cuts and Kinks

The Exchange of Ideas Leads to Progress

Splicing 18 in. Beams

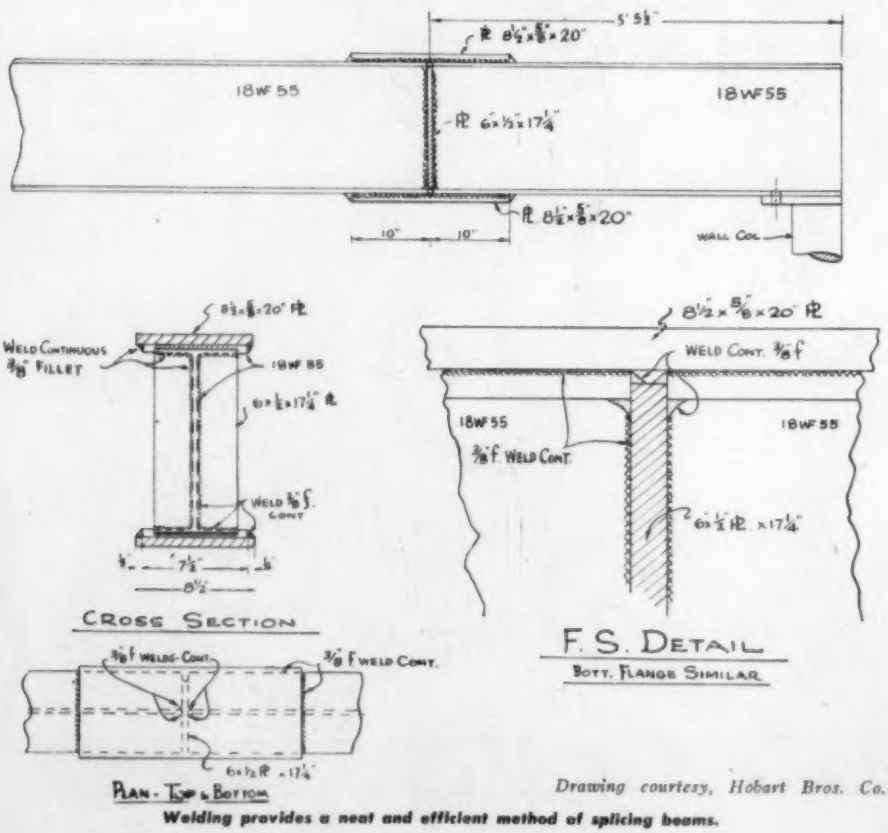
By *FRED HOROWITZ*

UNABLE to purchase 18 in. beams of the length it required, the County Iron Works, Port Chester, N. Y., was forced to devise a quick and economical means of using some of the short pieces of 18 in. beams that were on hand. By means of welding, the beams were spliced together to meet the requirements of the project. The cost was surprisingly low as compared to riveting, and the architect was very much pleased by the neat and finished appearance of the work. No postweld heat treatment was necessary.

A comparison of the costs of the riveted and welded methods of splicing 18 in., 55 lb WF beams is given below. Riveting, the previous method used for splicing, required the punching of each member—which doubtless helps to account for its high labor costs as compared to welding.

Riveted Splice	
Material, incl. 60 rivets	$ 7.00
Labor	23.00
TOTAL	$30.00
Welded Splice	
Materials	$3.50
Electrodes	.50
Labor	5.00
TOTAL	$9.00

To the best of my knowledge, I have never seen or heard before of the type of splice used for the beam web (details in accompanying sketch). Note that the joint permits a double weld, thereby securing double strength.



Drawing courtesy, Hobart Bros. Co.

Welding provides a neat and efficient method of splicing beams.

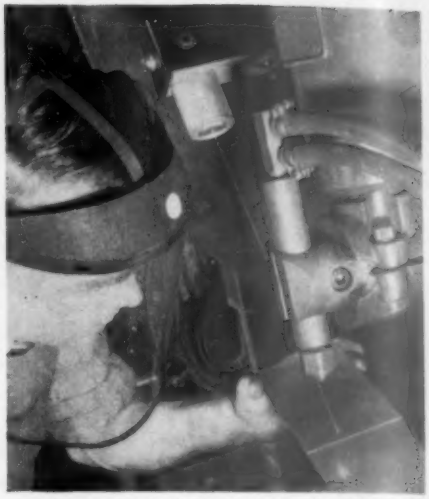
Help Wanted, *please!*

THIS is the one place where you may "get more than you put in," for all the ideas given here are yours without contributing anything in return. Don't be that kind of fellow, though! If you have a welding idea to pass on, then get the kick of seeing your name in print, help others to win the war and help us to keep this feature alive. Send anything you think suitable to Short Cuts and Kinks, THE WELDING ENGINEER, 506 South Wabash Ave., Chicago 5.—*The Editors.*

Spotlight for Spot Welding

By *A. B. WHITE*

WHEN SHEETS of aluminum are placed between the electrodes of a spot welder, the operator is unable to tell the exact spot at which the copper electrodes will clamp together to make a weld. To overcome this difficulty, I devised a pinhole lamp which throws a tiny dot of light at the tip of the lower electrode. This pin-point of light will show the operator, before the electrodes come together, the exact area at which the weld will be made. Thus the operator can accurately determine in advance whether or not he is spacing his spots evenly. The result is a stronger and more uniform spot-welded seam.



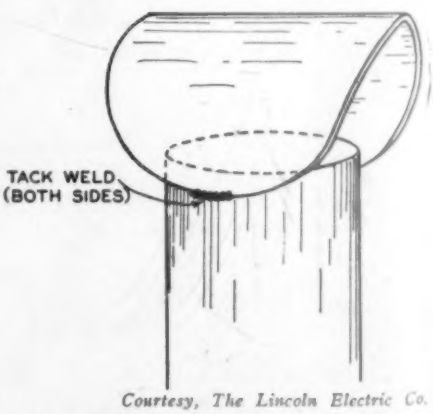
Courtesy, Westinghouse Electric & Mfg. Co.

Spotlight aids spacing of spot welds.

Welded Exhaust Cover

A SIMPLE protective cover for an engine exhaust (or for any pipe, flue or other outside outlet which is subjected to rain or snow) can be easily made with the aid of arc welding at practically no cost.

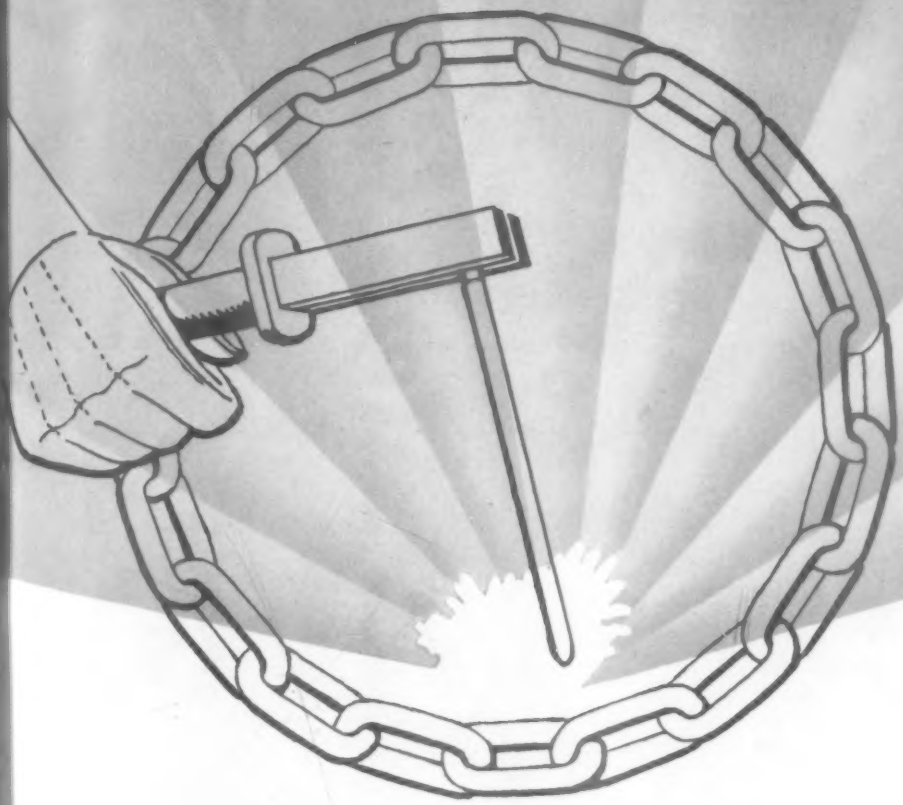
The only material needed is a circular piece of metal of the desired size and thickness. Scrap punch press stampings are frequently used for this purpose. The metal disc is bent into a U-shape as shown in the sketch and tack welded on each side near the top of the exhaust outlet.



Courtesy, The Lincoln Electric Co.

A circular disc of sheet metal makes an effective cover for an exhaust valve when it is shaped and tack welded as shown here.

NOW you can GET these McKay Welding Electrodes



These Commercial Grades of Stainless and Mild Steel Welding Electrodes are now available.

McKAY STAINLESS STEEL ELECTRODES

(All Diameters .075"* to ¼")

18-8, Type 308
18-8 Cb., Type 347
18-8 Mo., Type 317
25-12, Type 309
15-35, Type 330
15-60
25-12, Type 309
25-20, Low Carbon-Heat Resistant

STRAIGHT CHROMIUM

4-6 Cr., Type 502
12 Cr., Type 410
16 Cr., Type 430
18 Cr., Type 442
28 Cr., Type 446
TOOL AND DIE

McKAY MILD STEEL ELECTRODES

(All Diameters 3/32"* to 5/16")

No. 16—A.W.S., E-6020 & E-6030
No. 15—A.W.S., E-6010
No. 17—A.W.S., E-6012
No.116—A.W.S., E-6012 & E-6013
No. 3—A.W.S., E-4520 in straightened and cut lengths or coil form for automatics
No. 19—Cast Iron

*We can now give good service on orders for small sizes such as—.075" and 3/32", formerly so hard to get, because of recent increases in our capacity for producing the smaller diameters.

An easing supply situation now makes McKay Stainless and Mild Steel Electrodes available for commercial purposes. A list of these two grades for nearly every type of arc welding, appears at the right.

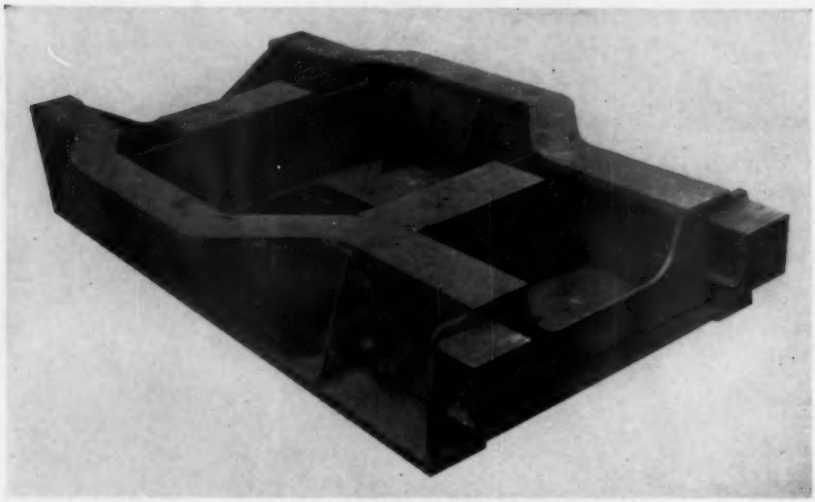
If you have been having trouble obtaining the Electrodes you require, here is an opportunity to get these grades from The McKay "researched line." Inventories are being gradually built up which should permit a more consistent supply of most of these analyses both now and in the future.

Your inquiry or order will receive prompt attention.

General Sales Office: York, Pa.

THE McKAY COMPANY
PITTSBURGH, PA.

WELDING ELECTRODES . . . COMMERCIAL CHAINS . . . TIRE CHAINS



Courtesy, Midland Paint and Varnish Co.

This welded steel base is sprayed with a spatter preventive before stress relieving as well as before welding.

Saves 40% Cleaning Time

By *ROSS YARROW*

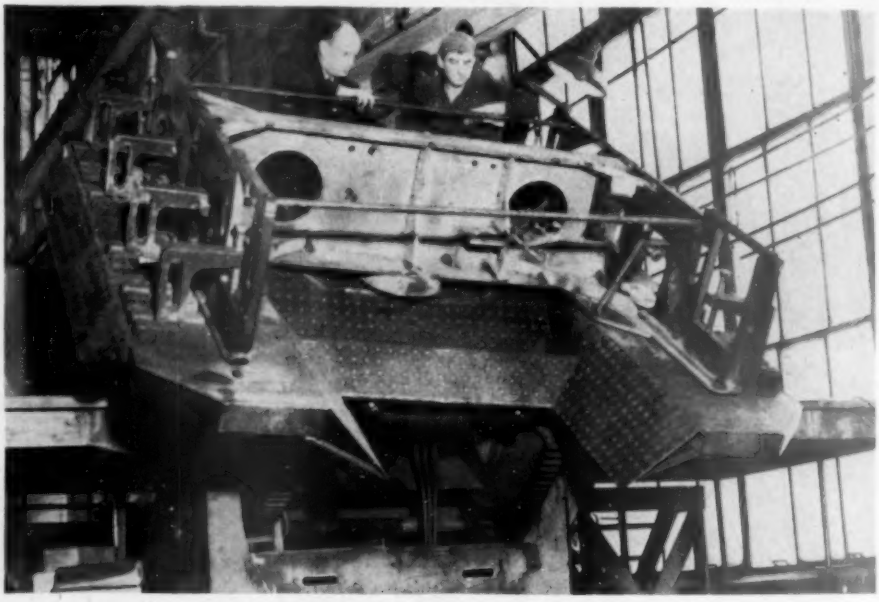
Supt., Republic Structural Iron Works

ANY METHOD that promises to save time and make work easier for the shop men is encouraged in our welding department. In the fabrication of welded steel bases, which are designed with numerous ribs welded at right angles to steel plates, the cleaning of weld spatter was a considerable item in our labor costs. This was solved by using a proprietary spatterproof liquid. We first brushed it on the steel, covering about 2 inches on each side of the weld.

Alex Dawson, our welding foreman, decided that brushing was too slow so he designed a simple spray to eliminate it. He cut a ¼ in. pipe with a hack saw far enough to permit easy bending, bent it 90 deg and attached a short piece of rubber hose. By putting the pipe in a bottle of the spatterproofing liquid and attaching the bent pipe to an air line hose, he had a spray that worked on the suction principle.

Obviously, a larger surface was covered by the liquid when the steel base was sprayed. This led to another important time and labor saving discovery. After these bases are fabricated they are placed in a furnace and given a stress relief heat treatment —heating slowly to 1,200 F, holding the heat for 2 hours and then cooling slowly in still air. This treatment relieves shrinkage stresses in the welded steel, but results in an oxide film deposit on the steel and seems to make mill scale harder to remove. Dawson noticed that the mill scale was looser and the oxide film was much easier to remove on surfaces that had been protected by the spatterproof liquid.

All steel structures are now completely sprayed with spatter preventive before and after welding. Even though they may remain in an open yard for several days while waiting their turn to go in the furnace, the surface is protected from rusting. Instead of the usual 3 hour cleaning time per base after heat treatment the time has been reduced to 1¾ hr. We also have a much cleaner and smoother surface to receive the priming coat of paint.



Non-skid floor plates provide safe footing for welders.

Safe Welding

WHEN WORKING on weldments which have been mounted on large positioners, the weldor often has difficulty in maintaining his footing. Non-skid floor plates have been welded at an angle around the turntable on the welding positioner pictured here, thus placing a level floor under the operator regardless of the tilt of the table. This idea has been used extensively at General Electric's Erie Works, where heavy locomotives must be welded. It provides greater safety in the use of welding positioners for large weldments.

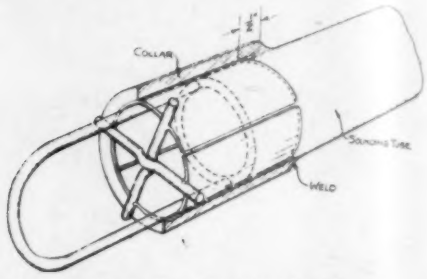
« »

Pipe Collar Jig

By *R. W. DAY*

THE COLLARS or sleeves used in the sounding tubes of C-2 cargo ships are usually constructed from the next larger size of pipe. Previously, it had been the practice to hold these collars by hand while they were being welded to the sounding tubes. The result was that the collars were seldom concentric with the tubes and were often set at axial angularity to them.

A simple jig was made up for each size



A pipe collar jig suggested to the Labor Management Committee at Richmond Shipyard No. 1, Richmond, Calif.

of collar. This consists basically of a cylindrical sheet metal shim of thickness corresponding to the gap between the tube and the inner diameter of the collar. Slipped into the collar, the shim centers it around the tube. Stops are welded to the shim to govern the degree of telescopic engagement of the tube and collar and also the distance that the shim is permitted to enter the collar.

In the 1½ in. size pictured, the inside diameter of the collar is about $\frac{1}{16}$ in. larger than the outside diameter of the pipe. Hence a circular split shim of about $\frac{1}{32}$ in. thickness will equalize the difference between the pipe and collar diameters. A pair of cross bars is welded to the outer end of the shim, and a looped handle enters into and is welded within it. The ends of the handle are positioned to serve as stops, limiting the distance that the pipe may enter the collar, while the cross bars serve similarly to limit the distance that the shim may enter the collar. Since the shim terminates about ½ in. from the end of the collar (see sketch), it will not be affected by the welding done to join the collar to the pipe.

All collars have been perfectly aligned with the sounding tubes since this type of jig was introduced.

On the Job

Holding Close Tolerances

A LARGE vessel recently completed by Leader Iron Works, Inc., Decatur, Ill., had to measure exactly 50 feet long, with no plus or minus when completed. Furthermore, twelve 4 in. flues were welded in place, and the flue sheets had to be within plus or minus one minute of 90 deg of the shell or tube sheet center line.

Courtesy, The Hobart Brothers Co.

No expansion or contraction tolerance was allowed in this 50 ft welded vessel.

This vessel was made in seven courses. Each course was turned up square on centers in a lathe and beveled 30 deg; four tram marks for fit-up purposes were then put on each end of the course. To fit up, face plates were put in the floor and large angle irons were used to hold the flue sheets. A water level was used for leveling.

The customer checked with surveyor's instruments and found out that the finished vessel was exactly 50 ft long and within the $\frac{1}{8}$ in. out-of-round tolerance that had been allowed. The flue sheets were absolutely parallel to one another, and no facing was necessary after welding.

The welding was done with a 600 amp welder, using $\frac{3}{32}$ in. electrodes.

» «

Ploughshare Repaired

FROM REMOTE New Zealand comes evidence of the savings that can be effected by welding worn and broken farm machinery. The photograph reproduced herewith was sent to the United States by a New Zealand weldor, Robert Edelsten, who says:

"I have now begun one of our busiest times of the year, for ploughing is in full progress, and shares, like most things, are very difficult to obtain. So again the weldor has to come to the forefront. The photograph shows very clearly the location of the heavy weld beads on a share which I have just repaired. The welding was all done on ½ in. plate, and I saved a great amount of time by using $\frac{5}{32}$ in. and ¼ in. electrodes.

"The finished share measures 19 in. long by 18 in. wide and will turn a 22 in. furrow. If it had been obtainable, a new share of this size would have cost approximately $25. To repair the share by arc welding cost the farmer about $12.50."

» «

Two Tons of Shears by Air

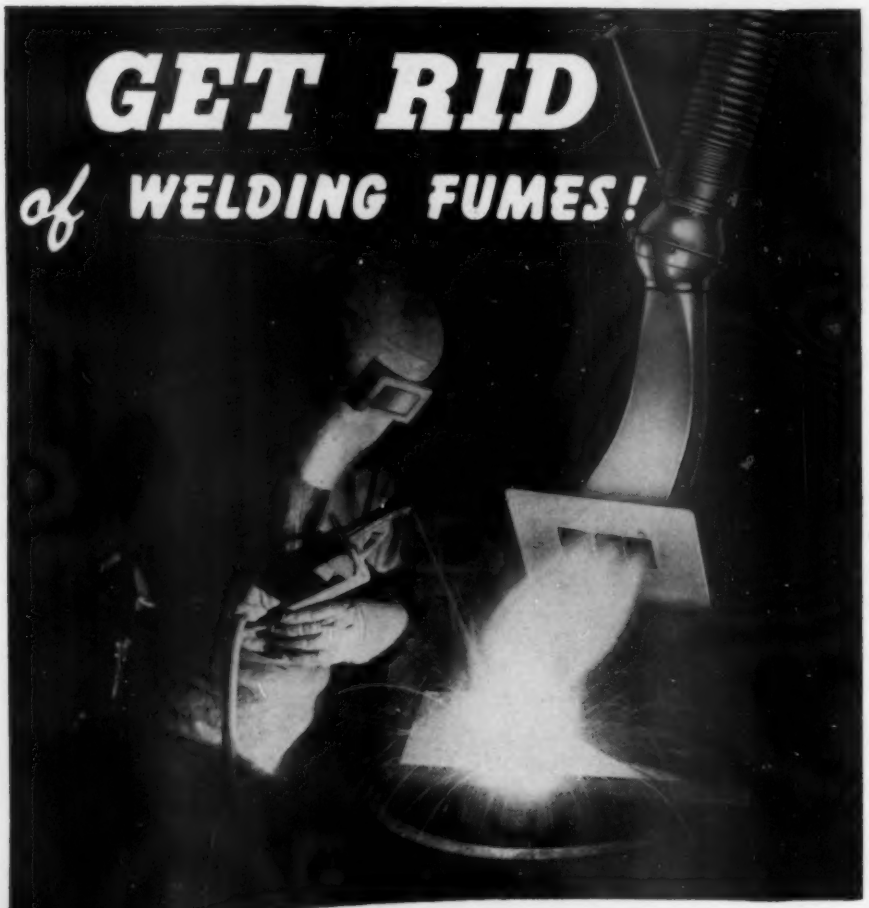
LOCKHEED AIRCRAFT Corporation, Burbank, Calif., found itself in urgent need of rotary shears, which could not be obtained less than half a continent away. Since the shears were needed in order to carry out a vital phase of war production, Lockheed appealed to the Army Air Force for aid.

The AAF was quick to coöperate: two rotary shears, each weighing 2,000 lb, were picked up at the plant of the Whiting Corporation, Harvey, Ill., loaded into an Army plane and flown overnight to Burbank. Within 24 hours after their completion, the shears were in operation at the Lockheed plant.

Below: The crates contain two rotary shears, each weighing one ton, which were flown from Illinois to California in an Army plane.

Courtesy, The Lincoln Electric Co.

Large ploughshare which was repaired by arc welding after it had become unfit for further use.



RUEMELIN FUME COLLECTORS draw Smoke and Heat Away at the SOURCE!

Now — Your fume problems can be solved quickly and efficiently by installing Ruemelin Fume Collectors. Powerful suction draws out noxious gases, smoke and heat *at the source.* Guards employee health, resulting in less welder fatigue, therefore greater plant output. Has many exclusive features: (1) Clears shop air with minimum loss of building heat. (2) Exhaust snout can be positioned instantly and conveniently. (3) Covers maximum welding territory, vertically, horizontally and by circle swing. (4) Shipped completely assembled, easy to install. More than 1,000 units serving war plants all over the nation. Write for Bulletin 37-C.

Also manufacturers of Sand Blast Equipment and Tubular Cloth Dust Filters. Ask for literature.

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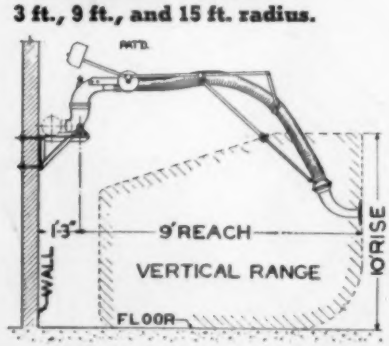
3 STANDARD REACHES: 3 ft., 9 ft., and 15 ft. radius.



Arm extended for maximum reach. Note unusually wide working range.

RUEMELIN
WELDING FUME COLLECTORS

A 4275-3/4

Fabricating Diesel Units

By C. U. Hansen
Warren City Tank and Boiler Co., Warren, O.

FOR THE fabrication of Diesel-engine crankcases and marine gear cases, we use 175 a-c arc welders of 500 amp rating. In addition, a 100 amp welder is employed to make templates, and eight 500 amp transformers and auxiliaries are used on production work. Miscellaneous jobs, such as tacking waster strips into position, are done by d-c welding.

All of this work must meet rigid specifications. The maximum allowable deviation from standard is plus or minus 1/8 in. in the overall dimensions of the crankcase assemblies and plus or minus 1/8 in. in the gear cases.

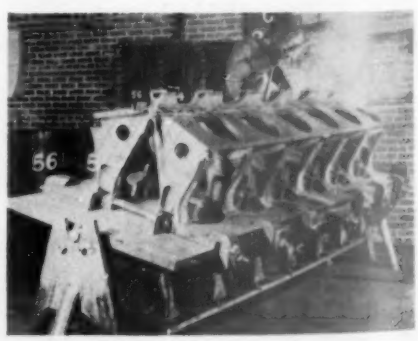
Welds are inspected by the magnetic-particle method as the work progresses and are inspected, in many cases, both before and after heat treatment. X-ray inspection is used extensively on the engine assemblies.

To insure that gear cases are absolutely oiltight, each case is filled with kerosene and allowed to stand for about ten hours. The presence of a leak then becomes evident since kerosene is able to seep through even the smallest opening in this long a period.

Production of the complete crankcase assemblies has been materially facilitated by making subassemblies. Frequently, these are made in groups of two each and afterwards cut apart. Welding is done from the center of the structure toward the end in order to minimize distortion. Subassemblies are stress relieved separately, and the complete assembly is also heat treated in order to relieve stresses.

Positioners and fixtures are used extensively. Many subassemblies (see picture) are placed on the positioners in pairs, one on each side, and held in perfect balance. The positioner can then be revolved manually by the operator to bring the units into position for downhand welding.

Another innovation has proved helpful in maintaining uniform welds. This is the use of waster strips which are tack welded to the ends of joints. The weld is started in the strip at one end and carried through the joint into the other strip, beyond the point where it is needed. After welding, the strip is removed by flame-cutting and grinding.



Courtesy, General Electric Co.

Subassemblies of Diesel-engine crankcases are placed on the positioners in pairs. Note the waster strips which have been tacked in position near the top and center of the unit.

HERCO ARC WELDERS

THE RESULT OF YEARS OF THE MOST EXACTING RESEARCH IN THE WELDING TRANSFORMER FIELD

PRECISION CONTROL

Variable Core construction permits stepless heat changes while welding. Magic Eye-Pilot indicates when machine is on.

STREAMLINED ARC

Instantly starting, smooth, flexible. Elimination of "arc blow" produces sound, speedy and uniform welds. X-Ray test beads.

LOWER COST

Power cost 50% lower than motor generators. No rotating parts at all, therefore supervision, oiling, replacement of wearing parts eliminated.

POWER FACTOR

corrected welders if desired.

MODELS

available from 150 to 2000 amperes.

OTHER PRODUCTS

Manufactured by Hercules are

MAGNETIC ALIGNERS
AC-DC RECTIFIERS
HEAVY DUTY—
THREE PHASE SOLENOIDS
FOR AUTOMATIC SPOT WELDING

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HEAVY DUTY CONSTRUCTION

Continuous 24 hour per day operation. Sturdy connectors, on-off switch or circuit breaker for lifetime of wear. Spun glass insulation.

Durable sheet-steel housing. Easy rolling, portable.

VC—250
(40 - 250 amps)

VC—375
(50 - 375 amps)

HERCULES ELECTRIC & MFG. CO. INC.

MANUFACTURERS OF THE PRECISION WELDER WITH THE

STREAMLINED ARC

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"TWO-TONE" Welding

REGISTERED TRADEMARK

cuts welding time

as much as

300%

•

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Results in time saved, in cost of new parts saved, and in increased length of service due to hard surfacing, are truly sensational.

•

Doubles life of tractor parts

Driving sprockets which cost new $180 a pair can be rebuilt by the "Two-Tone" Welding process in 22 hours for $39, saving $131 and giving the sprockets a life expectancy of twice that of new parts. Deposits will withstand severe shock, edge impact and abrasion. Let us tell you the whole story of "Two-Tone" Welding in our new eight page bulletin just out.

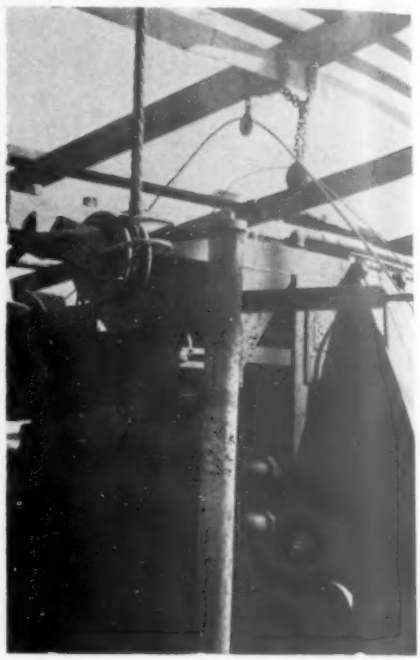
Send for Bulletin No. 7

Resisto-Loy COMPANY
GRAND RAPIDS, MICHIGAN

Line-Retaining Hooks

By Charles C. Lynde

AN AUXILIARY hoisting line had to be carried under a small sheave to insure its reaching the drum in the proper direction. Frequently, this line would fall away from its guide when slack and cause time to be lost while it was being realigned.



The two welded hooks prevent the hoisting line from falling away from the sheave when line is slack.

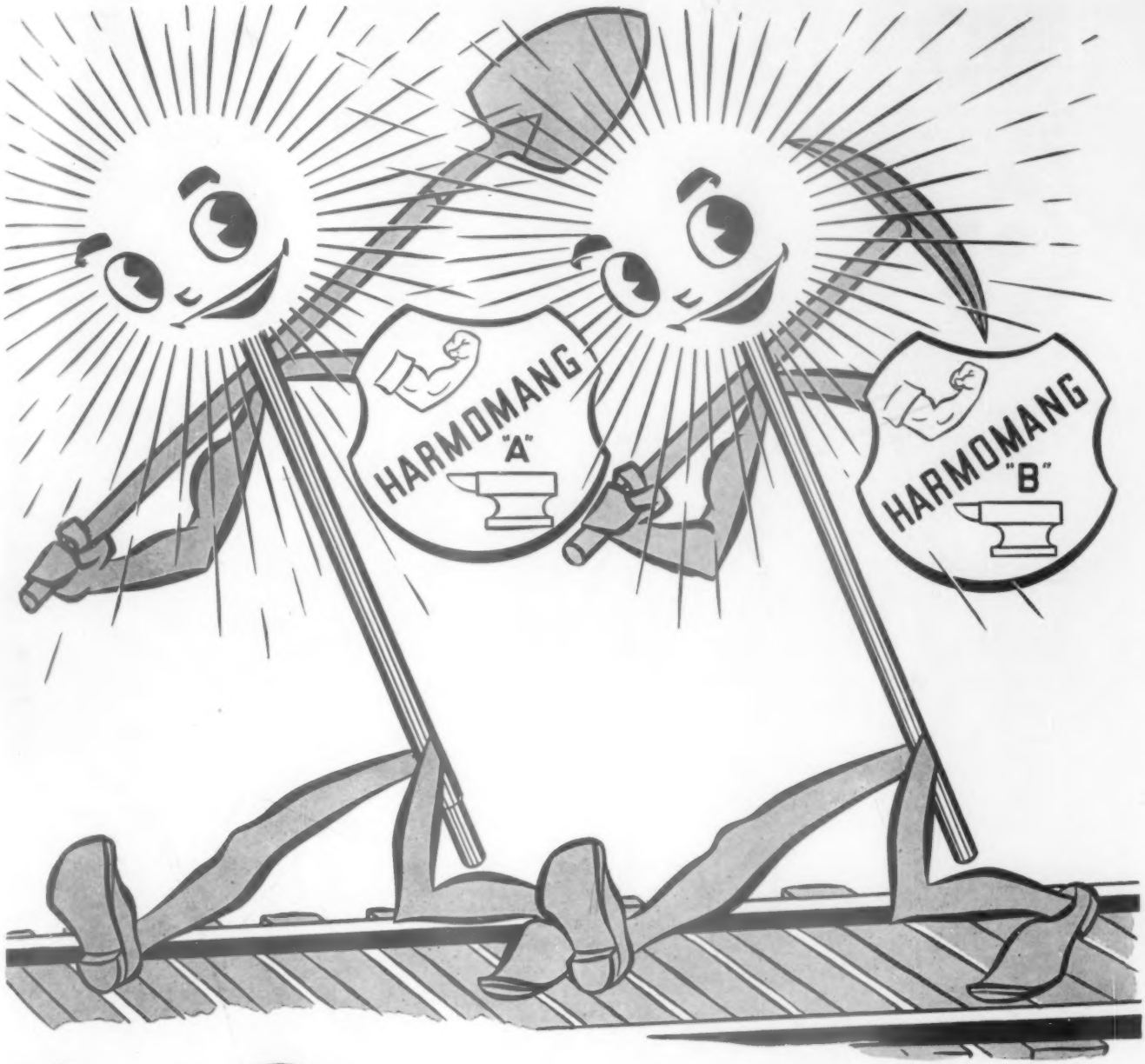
The company's maintenance weldor eliminated this difficulty by forming two hooks from 5/8 in. rod and welding one hook to each side of the sheave housing. Since one hook opens to the left and the other to right, there is, in effect, a complete retaining loop around the rope. The line, however, can be removed when necessary simply by carrying it down past the first hook, through the gap between them and beyond the second hook. It is even easier to rethread the hooks by reversing the aforementioned motions.

» «

Welding after Wedding

WELDING is generally admitted to be the best and most modern method of joining metals, but few people would ever associate it with the romantic role of strengthening the bonds of holy matrimony. Such, however, is the case with the married couple who are the proprietors of Ted and Helen Clement's Welding Shop near Adrian, Mich.

A graduate student of the Lincoln Electric welding school at Cleveland, Ted Clements soon induced his fiancée to share his interest in welding. She also took the Lincoln welding course and after they had fused their names together joined her husband as an active business partner. There is no job in the shop that his welding wife can't handle, says Ted.



Going Places... WHERE TOUGH JOBS WAIT

Here's the capable pair that takes over tough jobs on the railroads . . . in mines . . . in rock quarries . . . and on construction jobs . . . where tired steels need building up and new life.

Harmomang "A" and "B," both manganese-molybdenum electrodes, are ready to take heavy impact and abrasion. The thin coating on "A" stabilizes the arc and prevents loss of alloying elements. "B" is the same type of electrode without coating. For use on manganese and carbon steels, they have a hardness of 84-87 Rockwell B, but can be hardened to 43-46 Rockwell C.

P&H Alloy Electrodes serve *all* welding needs. The complete line includes types for hard-surfacing, resistance to wear, impact and abrasion, for welding stainless steels, 4-6% chrome steels, air hardening steels, etc. Your P&H representative will be glad to give you full information and procedures, or write us.

P&H Alloy Electrodes

P&H A.C. and D.C. Arc Welders offer the most in welding value. Simpler to operate, they cut operator training time. All are rated on WSR which tells actual delivered output — from minimum to maximum capacity. Models for all requirements. Early delivery. Write for full information.

General Offices and Factory: 4513 West National Avenue, Milwaukee 14, Wisconsin

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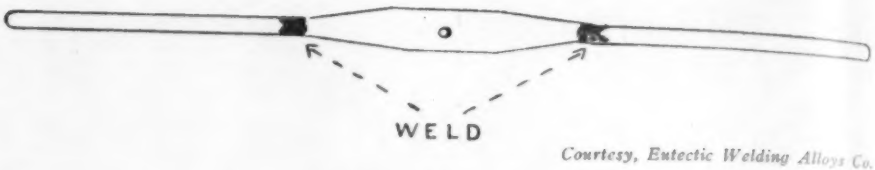
WELDING ELECTRODES • MOTORS • HOISTS P&H ELECTRIC CRANES • ARC WELDERS • EXCAVATORS

Canadian Distribution: The Canadian Fairbanks-Morse Co., Ltd.

Cores for Pipe Stems

ODDLY ENOUGH, a welding process is playing an important part in the production of stems for smokers' pipes. Such stems are made of plastic that is molded about a core, the construction of which is shown in the accompanying diagram.

These cores were originally made from a single rod and flattened in the center. This operation, however, was so costly and difficult that it was decided to make the core in three pieces and solder the flattened section to the two ends. Silver soldering was tried, but this process, satisfactory in so many applications, would not work here because of the high temperature needed for the molding. At molding temperature, the solder would soften, thus allowing the core to come apart.



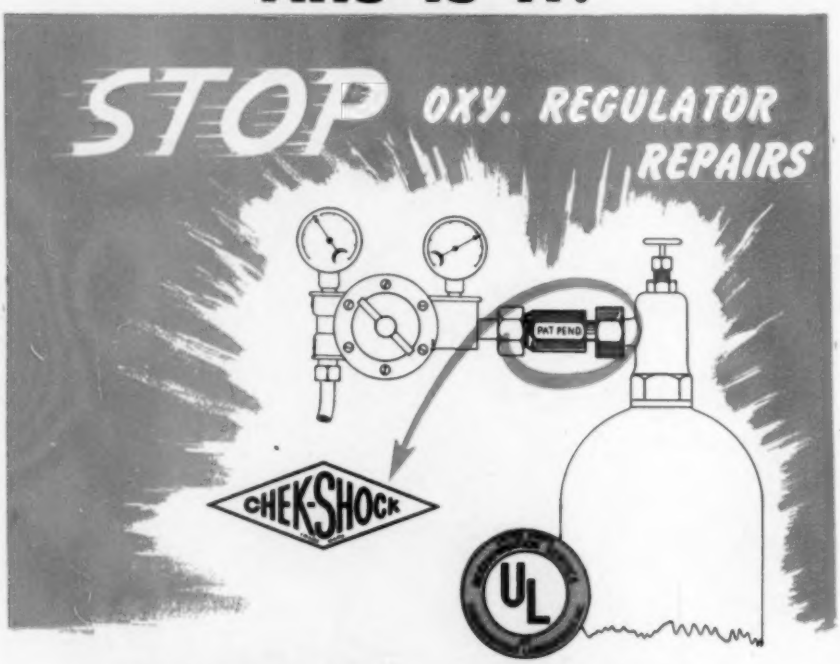
Courtesy, Eutectic Welding Alloys Co.

Core for molded plastic pipe stems. The center flat section is joined to the two outer sections by a low-temperature welding alloy.

A low-temperature welding rod binding at 1,300—1,600 F was next used and proved perfectly satisfactory. It gave a bond with a tensile strength as great as that of the steel itself. The remelting temperature of 1,750 F was sufficiently high to prevent softening at molding temperature, while the binding temperature was low enough to permit rapid and easy application. The finished joint was so smooth that practically no machining was necessary.

» «

THIS IS IT!



— CHEK-SHOCK Oxygen CUSHION Valve —

- Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.
- Will prevent unnecessary internal wear in regulator *(as, NOT necessary to release control screw before opening tank valve).*
- Will eliminate possible injury to operator from burstings.
- Will increase life of regulator assembly.

This NEW automatic safety device CUSHIONS the initial BLAST of pressure when tank valve is turned on *(this uncontrolled surge which strikes like a hammer, is the direct cause of most damaged regulators and accidents.)* Thereafter pressure slowly equalizes and then CHEK-SHOCK allows a full flow of oxygen.

ONLY ONE MOVING PART, POSITIVELY FOOLPROOF

PRICE IS LESS THAN ONE REPAIR BILL

Universal coupler type (will fit welding regulators)	$6.00
Screw-in type (for removable inlet stems, ¼" Std. Pipe)	5.00
Medical type (1" or 1⅛" size coupling nuts)	7.00
Medical type to fit commercial tank (eliminates use of adapter)	7.00

—OPENINGS FOR DEALERSHIPS—

send orders with ratings to

Safety Shock Manufacturing Co.
FOWLER, CALIFORNIA

Ship-Welding Mother

WITH two sons in the service and another a Jap prisoner, Mrs. Fanny Hutchinson, a weldor in the Wainwright Yard of the J. A. Jones Construction Co., Inc., Panama City, Fla., feels that she has "something to work for." Mrs. Hutchinson, who was elected to sponsor the Liberty Ship *Stephen R. Mallory* at its recent launching, has set a welding pace that has as yet been unequalled by any of her co-workers.

Courtesy, The Lincoln Electric Co.

Weldor Fanny Hutchinson, who has set a record welding speed for the Wainwright Yard at Panama City, Fla.

Her employers comment on this ship-welding mother as follows:

"Mrs. Hutchinson is now working on side shell assembly for fore and after peaks, which requires special skill as the plates are thick and eat up the rods. The work consists of finishing the outside as well as the inside of the shell, welding on the lifts and scars and welding the holes found in submerged melt welding. Her average on this work runs anywhere from 1,400 to 1,800 in. a day—she has gone as high as 2,100 in. on two-pass welding with ⅜ in. electrodes. Her leaderman says that he can use her on any type of welding with the assurance that she will do a good job."

* THEY DEMAND AND SPECIFY

...for transmission of special electrical energy that is supplied from welding apparatus to the arc where fusion takes place

*

U. S. NAVY—HAWAII
Over 300,000 feet

KAISER SHIPYARDS
Over 500,000 feet

JEFFERSONVILLE BOAT WORKS
Over 165,000 feet

J. A. JONES CONSTR. CO.
Over 100,000 feet

MOORE DRY DOCK CO.
Over 150,000 feet

CALIFORNIA SHIP BLDG. COMPANY
Over 400,000 feet

POLLACK-STOCKTON SHIP BLDG. CO.
Over 43,000 feet

SOUTHEAST SHIP BLDG. CO.
Over 100,000 feet

BATH IRON WORKS
Over 100,000 feet

HIGGINS CORP.
Over 100,000 feet

MISSOURI VALLEY BRIDGE
Over 125,000 feet

Quality and prompt shipments make "MAJOR" the preferred brand welding cable in shipyards, armsplants, and wartime industries.

"MAJOR" WELDING CABLE has WPB approved synthetic rubber jacket that has high tensile strength, maximum abrasion resistance, is tough, durable, water and oil proof. Super-flexibility is achieved by proper stranding of many fine copper wires, which form the conductor. Heavy paper separator strips easily leaving copper wire clean, for quick attaching to electrode holders and lugs.

DON'T ACCEPT SUBSTITUTES!

Demand *"MAJOR"* WELDING CABLE, the fastest selling cable on the market today. *"Major"* pioneered flexible, rubber covered (extruded type) cable. Today, only ten years later, *"MAJOR"* demonstrates its superiority in terms of many millions of feet in use all over the United States.

Available for prompt shipments.

SPECIFICATIONS

Size	Amps.	Strands	O.D.	I.D.	Wt. in lbs. per M ft.
6	75	950	.400	.210	132
4	125	1029	.495	.275	202
3	150	1323	.500	.305	235
2	200	1666	.560	.335	295
1	250	2156	.625	.400	373
1/0	300	2646	.675	.440	450
2/0	375	3381	.750	.490	570
3/0	450	4284	.815	.545	705
4/0	550	5376	.900	.635	860

WELDING ENGINEERING COMPANY
MANUFACTURERS - - DISTRIBUTORS
MILWAUKEE 2, WISCONSIN
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New Products to Use

IF YOU wish additional information on one or more of the items described in THE WELDING ENGINEER'S New Products section, please use the coupon appearing below. Simply write in the numbers of the items which interest you, sign your name and address and mail coupon to THE WELDING ENGINEER.

Filter for D-C Generator

1 An all-metal filter to protect welders of the d-c generator type from air-borne dust is being manufactured by **Badger Mfg. & Sales Co.** This is a permanent, cleanable filter, designed

Welding generator filter. It traps all dust particles before they can reach rotating parts of the equipment.

for quick and easy installation on all standard types of d-c generator welding units. By eliminating dust, it prevents excessive wearing of generator and excitor brushes and "frozen" or clogged rotors. The danger of arcing caused by dust in switches is likewise avoided.

Badger filters are also available for a-c transformer-type welders.

» «

Steel Grab

2 The **M.S.A. Steel Grab** was developed to handle steel plate or structural forms in various shapes and sizes, with edge thicknesses up to ⅝ in. The grab has a rated capacity of three tons, but each unit is subjected to a load of five tons before being released from the factory. The grab may be used for either lifting the plate vertically or pulling it horizontally. It is slipped into position over the plate edge and grips automatically as soon as the load is

M.S.A. steel grab. Weighing only 23 lb it will handle a load up to 6,000 lb.

applied. Two powerful toothed jaws close securely on the steel and hold it until the lift or pull is completed. The jaws operate on the principle of a pair of tongs so that the heavier the load, the tighter the gripping action. **Mine Safety Appliances Co.**

Thyratron Welding Control

3 A thyratron welding control for small spot welders is announced by the Industrial Control Division of the **General Electric Co.** It can be used with either welding tongs or a small

G-E thyratron spot-welding control panel, 230 and 460 volts, 50/60 cycles, 1/2 to 10 cycle weld time. For bench mounting.

bench welder and is particularly suitable for the spot-welding of vacuum tube parts. Other applications for which this control (in combination with the proper welding transformer) is desirable include the welding of solid or stranded wires to terminals of copper, brass, bronze, steel or ferrous alloys; the joining of two tinned-copper, steel or alloy wires; the spot welding of thin pieces of various alloys.

The new control is of the adjustable, synchronous-precision electronic type, in which three thyraton tubes perform all functions. Two Type FG-172 tubes control the primary current of the transformer and one Type FG-97 tube controls the firing time. The control is suitable for operation on either a 230 or 460 volt, 60-cycle power supply.

» «

Single-Lens Goggle

4 Just announced is the new all-plastic **"MonoGoggle"** designed to provide unobstructed vision combined

Willson "MonoGoggle." Lens is of clear plastic and can be replaced.

with comfort and high impact strength. Weighing only 1¼ ounces, this goggle can be worn comfortably over prescription glasses. Lens is of clear, non-shatterable plastic. **Willson Products, Inc.**

Editor, THE WELDING ENGINEER, 506 So. Wabash Ave., Chicago 5:
Please have literature sent to me on the following items:
(write in the numbers of those that interest you)

_____ _____ _____ _____ _____ _____

Name ..... **Title** .....

Company .....

Address .....

City ..... **State** .....

Number of Welding Operators in your plant .....

April, 1944

Why is he so interested in examining welds?

WHEN current-carrying parts are welded, the electrical engineer is vitally interested in the conductivity of the joint . . . in its ability to withstand short-circuit stresses.

Other groups may insist on good machinability, or high resistance to chemical attack. These are just a few of the new requirements *your* weldments may have to meet these days.

Why not review your welding techniques in the light of these new standards? If you'd like help with the job, just call the nearest Chase Sales Service Warehouse. The men there have the answers to your welding questions—or will get them quickly for you from Chase headquarters.

CHASE

CHASE BRASS & COPPER CO.

—Incorporated—
Waterbury, Connecticut
A SUBSIDIARY OF KENNECOTT COPPER CORPORATION

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO
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MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK
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† *Indicates Sales Office Only*

This is the Chase Network—handiest way to buy brass

If it's a Titan weld

it's

✓sound
✓strong
✓ductile
✓uniform

The superior welding qualities of Titan Bronze Welding Rods didn't just happen. Back of each Titan rod are the resources of an organization of Brass Specialists with more than a quarter-century of experience in the production of Quality Alloys.

Among the factors contributing to Titan's superiority are: Use of only the purest of raw materials; strict laboratory control of mixtures and casting temperatures; Double Deoxidation*, a development of Titan metallurgists, which increases ductility of the weld, reduces fuming to a minimum.

Wherever oxy-acetylene bronze welding is used, for repairs or on production work, from coast to coast, Titan Bronze Welding Alloys provide welds that are Sound, Strong, Ductile, Uniform.

*Titan Doubly-Deoxidized Welding Alloys are PENN BRONZE, TITAN BRONZE, TITAN MANGANESE BRONZE.

TITAN METAL MANUFACTURING CO. BELLEFONTE, PA.
NEW YORK CHICAGO SAN FRANCISCO

TITAN *Welding Rods*

New stabilized-arc welder designed by Westinghouse engineers for the welding of thin sheets.

Arc Stabilizer

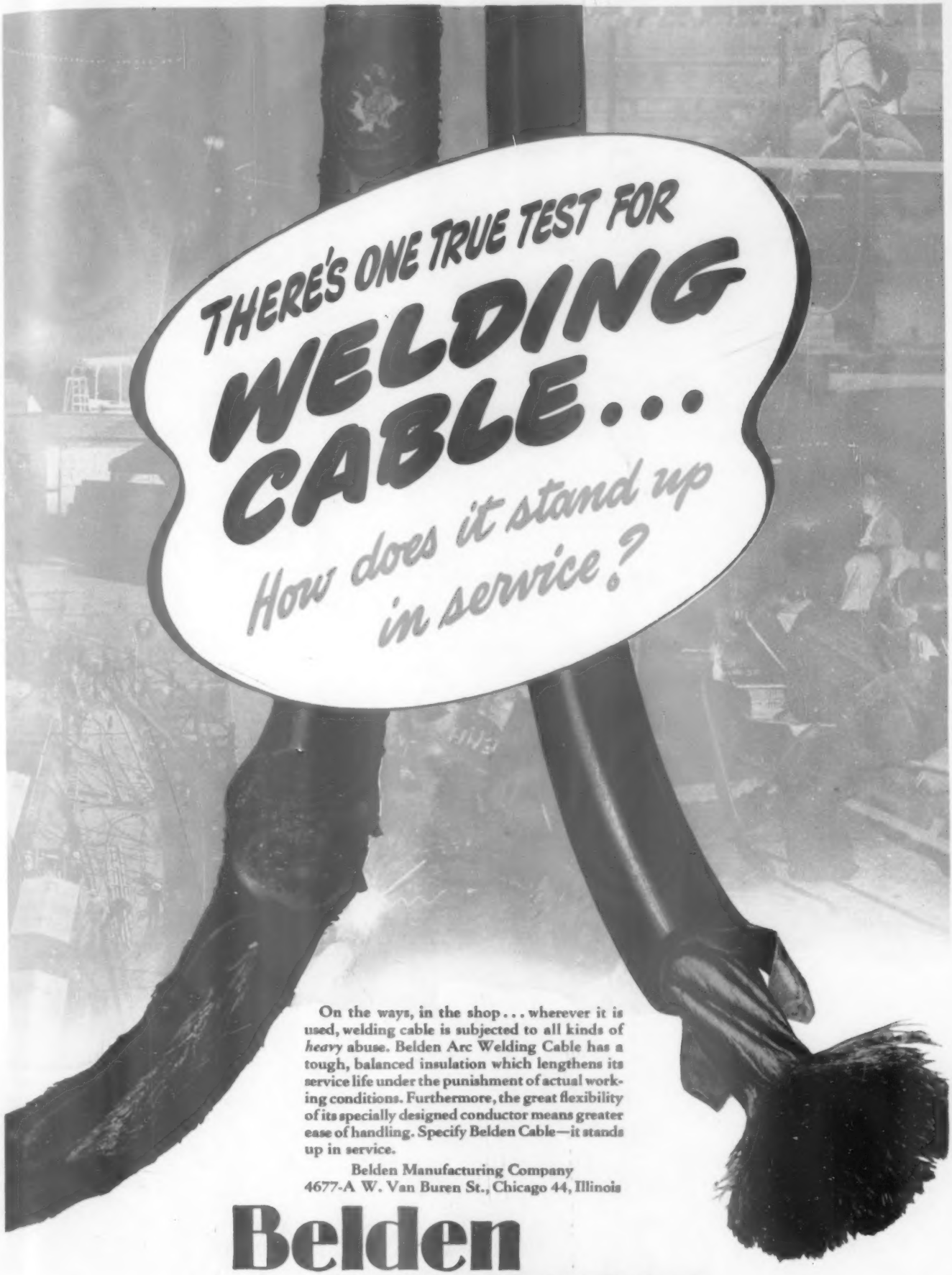
5 An arc stabilizer has been developed by engineers of the **Westinghouse Electric and Mfg. Co.** in order to facilitate the arc welding of the thin gauge materials used in the aircraft industry. Used with an a-c welding current, the stabilizer superimposes a high-frequency voltage wave of about 250 kilocycles on the welding current. This high-frequency voltage keeps the arc stream ionized during the reversals of the low-frequency (60 cycle) welding current. Under these conditions, the a-c arc is rendered stable and will not go out easily, even though very small welding currents are being used.

» «

Protective Cape

6 The **"Pro-tecto-cape"** is made of high grade chrome leather and is provided with underarm flaps and a collar which may be turned up to shield the wearer when he is doing overhead welding. The collar is securely held in the upright position by means of tabs and a snap fastener. The bib front is also equipped with snap fasteners for easy removal. **Eastern Equipment Co., Inc.**

"Pro-tecto-cape." It gives the welder protection in all welding positions.



On the ways, in the shop . . . wherever it is used, welding cable is subjected to all kinds of *heavy* abuse. Belden Arc Welding Cable has a tough, balanced insulation which lengthens its service life under the punishment of actual working conditions. Furthermore, the great flexibility of its specially designed conductor means greater ease of handling. Specify Belden Cable—it stands up in service.

Belden Manufacturing Company
4677-A W. Van Buren St., Chicago 44, Illinois

Belden
Welding **CABLE**

Awarded the U. S. Treasury Special Citation of Merit for initiating the War Bond-or-Cash Dividend Plan

HAVE YOU DISCOVERED —

The many advantages that result from membership in the AMERICAN WELDING SOCIETY

The opportunity is offered to everyone interested in welding. The roster includes leading engineers, production men, contractors, sub-contractors, company officials, research men, students, draftsmen, purchasing agent, foremen. Many government officials are members, also.

Write for booklet

THE AMERICAN WELDING SOCIETY
33 West Thirty-Ninth Street
New York 18, N. Y.

Sciaky "Dynatrol." It replaces magnetic contactors on electromagnetic-type stored energy resistance welders.

Current Interruptor

7 The "**Dynatrol,**" a new device for the high-speed current interruption of inductive d-c circuits, has been designed to replace the magnetic contactors formerly used on Sciaky resistance welders of the electromagnetic stored energy type. While these magnetic contactors have proved effective, the continuous arcing necessitates periodical maintenance and replacement and results in some power loss. The Dynatrol is arcless and thus increases the efficiency of the system. Because of its shorter charging time, it will result in 20% greater operating speed, states manufacturer.

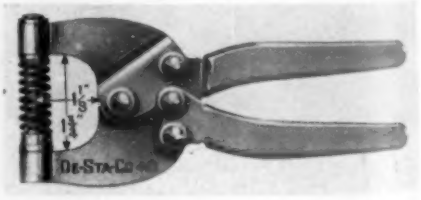
The device is essentially a high-speed, single-pole interruptor having contact points shunted by a bank of capacitors. The movable contacts open with a very high acceleration so that at any instant they have separated sufficiently to prevent a discharge while the primary current is directed to the capacitors. The Dynatrol is available on all stored energy welders of this manufacture up to and including 50 kw. **Sciaky Brothers.**

» «

Self-Adjusting Clamp

8 **De-Sta-Co Model 462** portable clamp is featured by the fact that it automatically adjusts itself to varying thicknesses of work. Its range of adjustment is from 0 to ⅜ in. Its small size, 7¼ in. overall length, is said to make it particularly adaptable to jobs where space limitations are an important consideration. **Detroit Stamping Co.**

No. 462 portable toggle clamp. It automatically adjusts itself to the thickness of the work.



(New products continued on page 73)

PIPE LAYOUT

By JOHN E. BRIDGES

WELDORS will find a roundabout a handy aid when they are required to do pipe layout work. A roundabout can be a belt or a thin piece of durable material such as ⅛ in. sheet packing. If packing is used, it should be cut into a rectangular strip about 1½ in. wide and sufficiently long to wrap around the largest piece of pipe to be cut. The roundabout is used primarily to aid in scribing an accurate cutting line around the pipe.

After a little practice, the roundabout may be used to save valuable time in the preparation of piping for welding. With its use, it is possible to lay out accurately offsets, reducers and elbows at various angles. This method renders unnecessary the use of a template for marking the lines for the cuts, and one can soon obtain accurate results. However, templates will save time when large quantities of a similar piece are to be made.

Fig. 1 shows how the roundabout is used for marking the pipe surface preparatory to making the cut. Since the miter cut is measured from the center line, it is not necessary to have any other lines. Fig. 2 gives the procedure for the layout for an unknown angle. A bevel square is used to transfer the pipe directions to a straight edge in order to obtain the dimension "D".

A 45 deg branch or "Y" connection can be prepared as shown in Fig. 3, using roundabout as shown in Fig. 1. Fig. 5 shows the method to be used to cut a piece from a 90 deg elbow to fit any turn with less than a 90 deg angle. A tape should be used instead of the roundabout for marking the line of the elbow.

Fig. 4 shows the application for laying out a pipe reducer by using a segment template, which gives results sufficiently accurate. However, it may be necessary occasionally to shift the template slightly on the last cut. The procedures for offsets shown in Figures 7 and 8 are self-explanatory and can be easily followed after a little practice. Fig. 9 gives a method for preparing the pipe for a 90 deg branch connection—a method without the use of a template.

Short cuts such as these will enable a pipe weldor to do his work faster, with less complications in the layout, by saving the time necessary for making templates. But, as previously stated, templates give better results where the number of parts of the same kind is large enough.

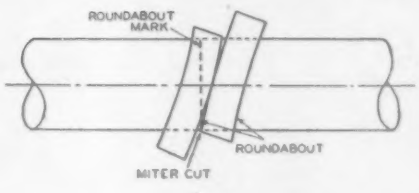


Fig. 1

Sketches, courtesy The Lincoln Electric Co.

METHOD FOR LAYING OUT MITER JOINT OF UNKNOWN ANGLE

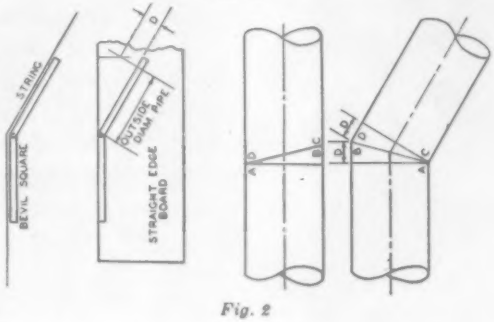


Fig. 2

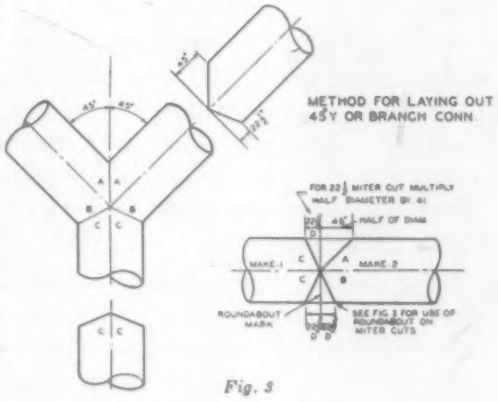

METHOD FOR LAYING OUT 45° Y OR BRANCH CONN.
FOR 22½° MITER CUT MULTIPLY HALF DIAMETER BY .41
HALF OF DIAM
MAKE 1
MAKE 2
ROUNDABOUT MARK
SEE FIG. 3 FOR USE OF ROUNDABOUT ON MITER CUTS

Fig. 3

METHOD FOR LAYING OUT 6 PIECE REDUCER

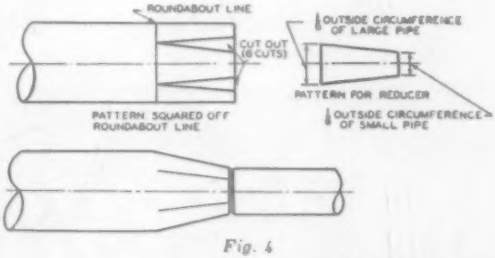
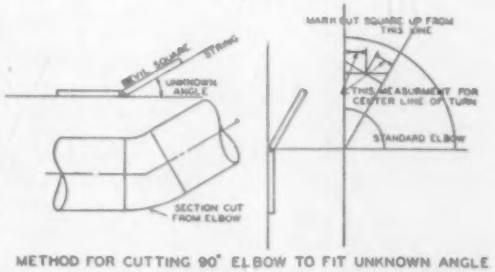

ROUNDABOUT LINE
CUT OUT (6 CUTS)
OUTSIDE CIRCUMFERENCE OF LARGE PIPE
PATTERN FOR REDUCER
PATTERN SQUARED OFF ROUNDABOUT LINE
OUTSIDE CIRCUMFERENCE OF SMALL PIPE

Fig. 4



METHOD FOR CUTTING 90° ELBOW TO FIT UNKNOWN ANGLE

Fig. 5

METHOD FOR LAYING OUT THREE PIECE ELBOW OR 90° TURN WITHOUT USE OF TEMPLATE

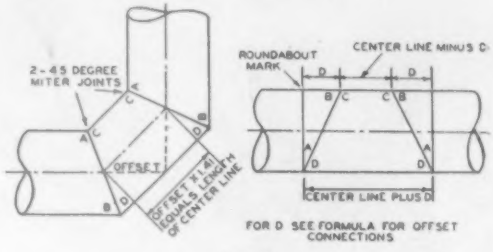

2 - 45 DEGREE MITER JOINTS
OFFSET
OFFSET X 1.41 EQUALS LENGTH OF CENTER LINE
ROUNDABOUT MARK
CENTER LINE MINUS D
CENTER LINE PLUS D
FOR D SEE FORMULA FOR OFFSET CONNECTIONS

Fig. 6

SHORT CUT FOR LAYING OUT 45° OFFSET

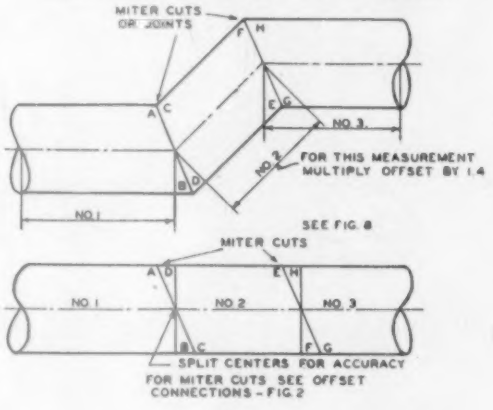
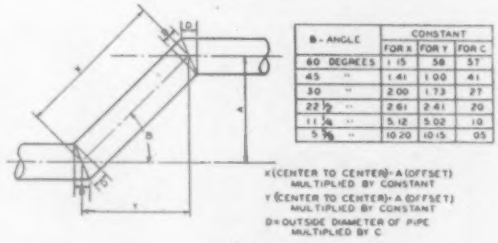


Fig. 7


X (CENTER TO CENTER) - A (OFFSET) MULTIPLIED BY CONSTANT
Y (CENTER TO CENTER) - A (OFFSET) MULTIPLIED BY CONSTANT
D = OUTSIDE DIAMETER OF PIPE MULTIPLIED BY C

B - ANGLE	CONSTANT FOR X	FOR Y	FOR C
60 DEGREES	1.15	58	57
45 "	1.41	1.00	41
30 "	2.00	1.73	27
22½ "	2.61	2.41	20
11¼ "	5.12	5.02	10
5⅝ "	10.20	10.15	05

Fig. 8

METHOD FOR LAYING OUT 90° BRANCH CONNECTION WITHOUT USE OF TEMPLATE

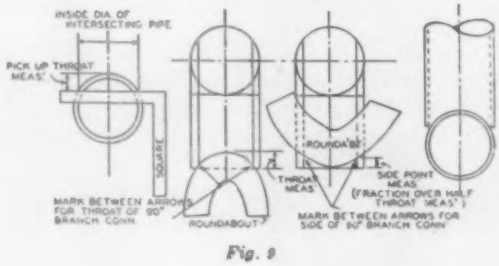

INSIDE DIA OF INTERSECTING PIPE
PICK UP THROAT MEAS.
SQUARE
ROUNDABOUT
THROAT MEAS.
SIDE POINT MEAS. (FRACTION OVER HALF THROAT MEAS.)
MARK BETWEEN ARROWS FOR THROAT OF 90° BRANCH CONN.
MARK BETWEEN ARROWS FOR SIDE OF 90° BRANCH CONN.

Fig. 9

FOR FASTER, BETTER WELDING-USE THE NEW Allison ELECTRODE HOLDERS

Simplified design — only three main parts — fully insulated — no exposed metal — slender lightweight, neatly balanced to eliminate operator fatigue . . . reduces maintenance, cuts electrode costs and increases welding production.*

Designed for high speed welding production, this new ALLISON Model A electrode holder is slender, easy to use, neatly balanced — easy to handle in awkward, hard-to-get-at spots. Fully insulated — no exposed metal parts — a compact, efficient holder built to meet the demand for a light, yet sturdy versatile unit. Quick rod change — left hand threads hold electrode tight and prevent slipping.

There are no springs — no handles — no gadgets to catch or snag when dragged by cable. ALLISON'S simplified design and construction reduces maintenance costs — permits burning electrodes to within ½" of holder tip. Holder is moulded of a high heat-resistant plastic that completely eliminates arcing due to slag or moisture.

On every welding job, an ALLISON electrode holder will help you to weld faster and better and at lower cost. See your local distributor or write direct for complete information.

Allison
TOOL & ENGINEERING COMPANY
4031 WHITTIER BOULEVARD
LOS ANGELES, 23 CALIFORNIA

* Made in two identical models — ALLISON Model A is built to handle heavier work, 300-500 amperes and weighs but 19 ounces. Model B is a 200 ampere holder weighing but 6¼ ounces.

New Products

(Continued from page 70)

Moslo laboratory-type extrusion press for producing small experimental runs of coated electrodes.

Electrode Extrusion Press

9 **Moslo Machinery Co.** announces an unusual machine which combines a 12-ton hydraulic extrusion press and an automatic wire feeding unit into an assembly occupying just two by four feet of floor space. While designed primarily for the extrusion of coated electrodes, the press may also be equipped with dies for extruding powdered metals, carbon and certain plastics. The machine is so designed that the press can be bought without the wire feeding unit if desired. A pressure of 10,000 psi can be achieved on the press, which (with the automatic wire feeding unit) is suitable for experimental small-scale production of welding electrodes.

» «

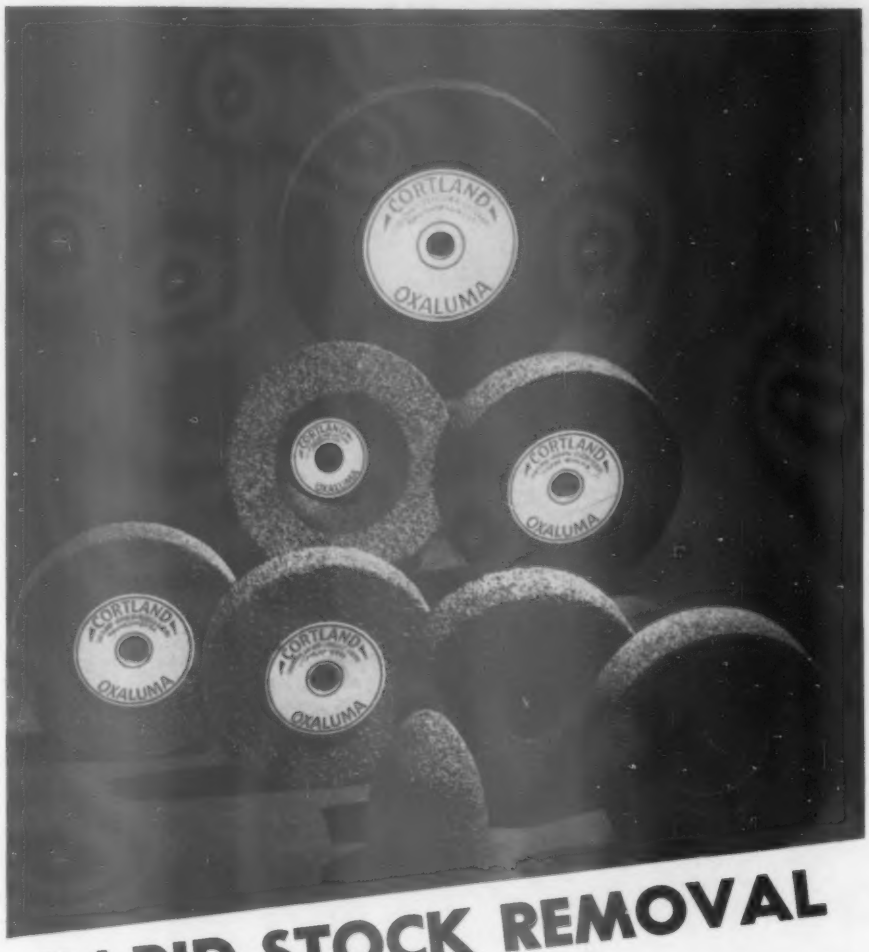
Iron Cement

10 **"Fix-Iron"** is an iron cement claimed to be effective for the repair of broken or cracked castings or for stopping leaks in boilers and other metal equipment. The product, in powder form, is mixed with water and applied without heating by means of putty knife or similar tool. According to the manufacturer, it hardens like iron and possesses the same expansion and contraction properties, thus assuring permanently tight joints. **So-Lo Works.**

» «

Salt Tablet Dispensers

11 The **"StaSafe Junior"** and **"Midget"** all-metal salt tablet dispensers are now back on the market after a two-year departure because of material restrictions. These restrictions have now been lifted. The larger size holds 1,500 ten-grain tablets and the smaller size 350 ten-grain tablets. **Standard Safety Equipment Co.**



RAPID STOCK REMOVAL
LONG LIFE - - -

. . . a winning combination you'll always find in Cortland Grinding Wheels. Made in all types and sizes for weld grinding with portable grinders: Vitrified bonded for 6,500 SFM and under; Resinoid bonded for high speeds up to 9,500 SFM.

Cortland has long specialized in wheels for weld grinding, and offers experienced engineering service. Modern production facilities and stocks promote better delivery.

Send in your inquiries to

CORTLAND GRINDING WHEELS CORP.,
15 Cortland Street, Chester, Massachusetts

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for better Weld Grinding

CORTLAND

CORTLAND GRINDING WHEELS CORP. • CHESTER, MASSACHUSETTS

Welded table for welding. Note the shelf space for electrodes and accessories.

Welding Tables

12 A new line of circular tables for welding is being fabricated by **Ed. J. Graves Weldery.** These are offered in three, four and five foot diameters with a height of 30 in. The top is of ⅜ in. steel plate and will lend itself to additional uses such as bending, forming, straightening, etc. Heavier plate or a different height may be furnished if desired.

» «

Air Control Valve

13 A compact solenoid-operated air control valve, **Ross model 835,** can be operated at sustained speeds up to as high as 400 reversals per minute; this is a ¼ in. heavy duty four-way valve for the control of double-acting cylinders. Overall dimensions are: length, 7 in.; width, 3½ in.; height, 5¼ in. **Ross Operating Valve Co.**

Midget air control valve for double-acting cylinders.

» «

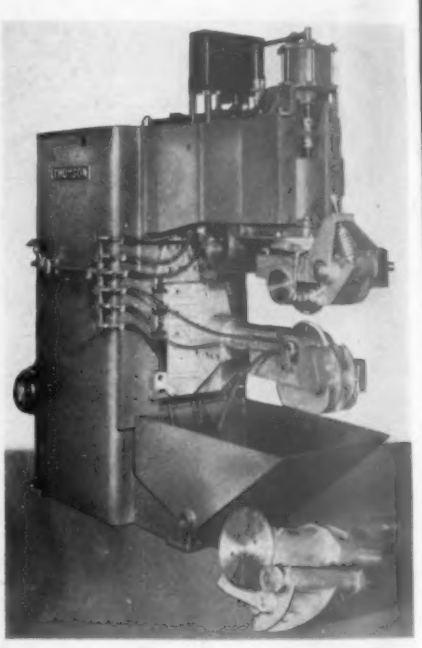
IT'S *Quicker* TO USE A

CMD *Triple-Duty* CHIPPING HAMMER

Triple Duty TYPE CB
3 tools in one. Brush replaceable when worn. Well balanced. Weight 1 lb.

With the Type CB combination drift and chisel hammer, a welder can greatly speed up his output. For he can spend more time welding and less time removing slag—less time laying down tools and picking them up. Without even setting aside the electrode, he can start immediately to chip away the slag. The handy replaceable brush on the handle of this hammer is instantly available when he needs it. For details and prices on this and other popular CMD welders' Chipping Hammers, ask your jobber for latest circular or write direct.

CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY
1928 WEST 46th ST., DEPT. W., CHICAGO 9, ILLINOIS



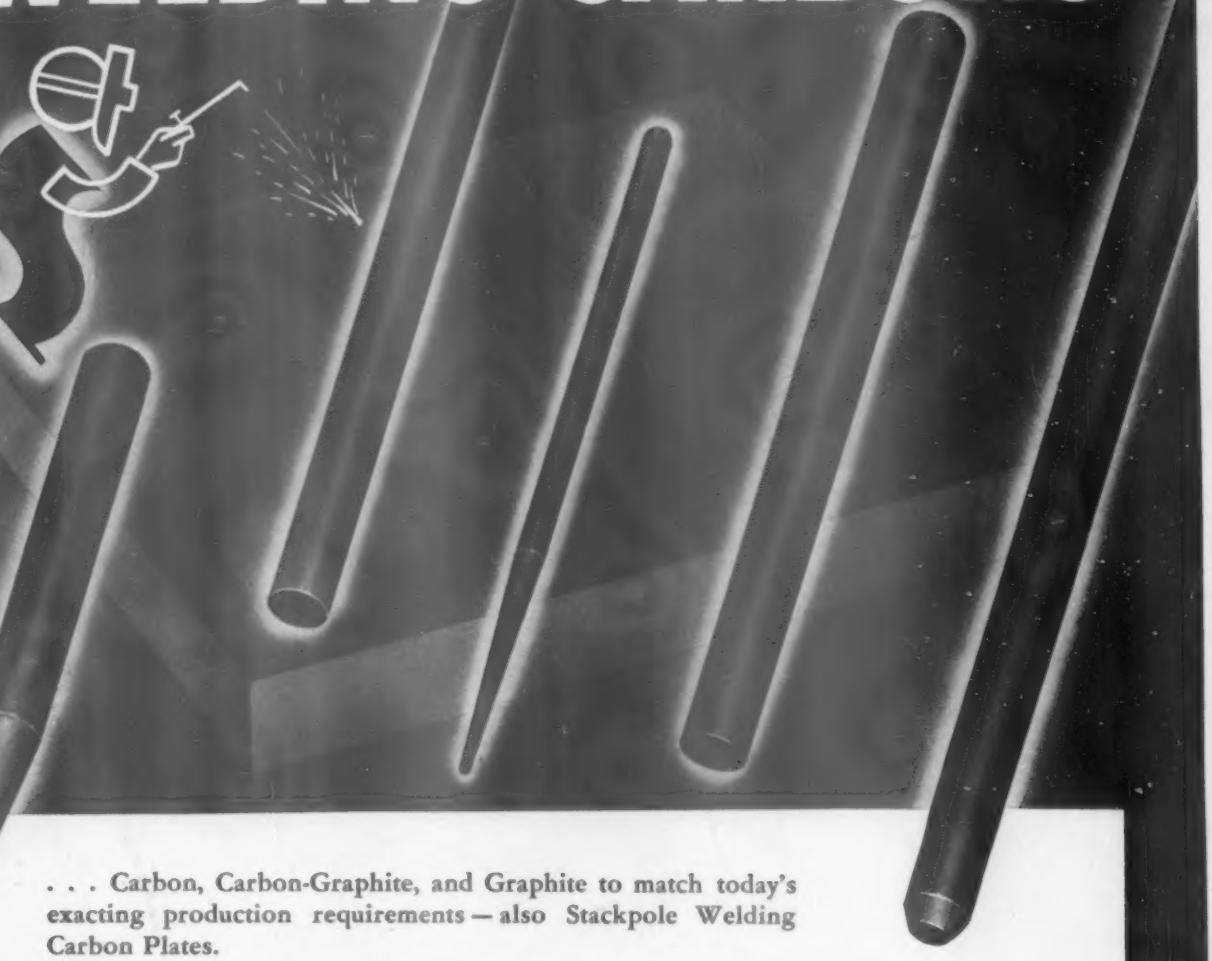
Thomson Model 35 seam welder. Note (foreground) the interchangeable lower arm which permits rapid conversion from longitudinal to circular seam welding.

Heavy-Duty Seam Welder

14 **Thomson Model 35** seam welder for heavy-duty welding jobs is available with transformers ranging in capacity from 250 to 400 kva and with throat depths of 18, 24, 30, 36, 42 and 48 in. The welding wheels may be equipped with gear or knurl drive, and the drive may be applied to either the upper or lower wheel. A wide range of welding speeds is available. **Thomson-Gibb Electric Welding Co.**

Use Coupon on Page 66 to secure further information on any item in the New Products section.

STACKPOLE WELDING CARBONS



. . . Carbon, Carbon-Graphite, and Graphite to match today's exacting production requirements — also Stackpole Welding Carbon Plates.

WRITE FOR DETAILS ON ANY OF THESE STACKPOLE PRODUCTS

- ☐ Welding Carbon Products
- ☐ Brushes (All carbon, graphite, metal, and composition types)
- ☐ Contacts (All carbon, graphite, metal, rare metal, and composition types)
- ☐ Brazing Blocks
- ☐ Anodes-Electrodes
- ☐ Packing, Piston, and Seal Rings
- ☐ Powder Metallurgy (sintered iron) Components
- ☐ Rheostat Plates and Discs
- ☐ Carbon Specialties

STACKPOLE ELECTRONIC COMPONENTS

- ☐ Iron Cores
- ☐ Switches
- ☐ Potentiometers
- ☐ Fixed and Variable Resistors

STACKPOLE CARBON COMPANY, ST. MARYS, PA.

"EVERYTHING IN CARBON BUT DIAMONDS"

Etcher and Demagnetizer

15 A new tool which may be used for either electrical etching of small tools and parts or for demagnetization has been developed by the **Ideal Commutator Dresser Co.** To etch, the parts are placed on the work plate and the switch is turned to the proper heat. Fourteen heats are available, giving a wide range (up to 1,350 watts) for marking iron, steel or alloy parts of sizes from small parts up to large castings. A ground clamp is provided for the etching of parts that are too large for the work plate.

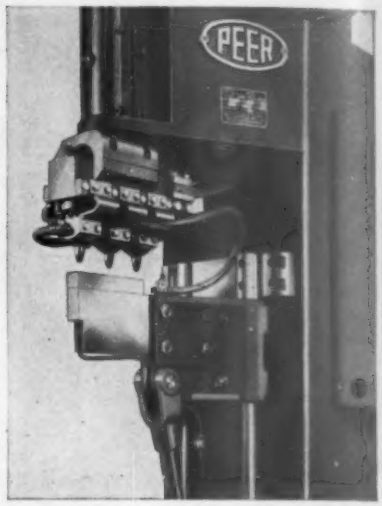
To demagnetize, it is only necessary to turn the "On" switch to either the No. 1 or No. 2 position and proceed as with an ordinary demagnetizer. Maximum rating, 5.5 amp; overall pole area, 13½ sq in.

Ideal combination etcher and demagnetizer. A useful two-purpose tool for the machine shop.

» «

Multiple Spot Welder

16 A three-electrode spot-welding head for use on a Peer press-type welder has been developed for assemblies which require a number of spot welds within close proximity. This head, according to manufacturer, made it possible to reduce the number of operations to 14 on a metal box that required 52 spot welds. The pressures are held uniform by the hydraulic equalization provided in the head. **Pier Equipment Mfg. Co.**



Peer air-operated multiple spot welder.

» «

Circular Slide Rule

17 Six inches in diameter, the **"Monitor"** slide rule has on its front side four scales—Log, C, D and CI (C inverted). The reverse side has sine and tangent scales and A and D scales for finding squares and square roots. Accuracy is said to be within ¼ of 1%—somewhat better than the accuracy obtainable on the usual 10 in. slide rule. The graduated scale lines are reproduced on white vinylite, which is both grease and water proof. Hence the rule is accurate under all moisture conditions. **Tavella Sales Co.**

» «

Portable Elevator

18 A portable hydraulic elevator that can be quickly set up for operation wherever electric power is available is announced by **Hufford Machine Works.** Briefly, the elevator consists of a fabricated steel base in which are carried the hydraulic oil tanks, pumps, motors and valves, outriggers for holding the unit stationary, telescoping hydraulic cylinders and a 6 by 6 ft work platform. A unit built compact enough so that it can be easily towed by a small plant towing car will lift a load of 3,000 lb to a height of 30 ft at a rate of 20 fpm when loaded.

Just a Sweet

PUR·RR·R

. . . that's all you hear from a MARQUETTE when it hits a tough job of welding. But, if you could look under the operator's helmet you'd perhaps find him "grinning like a Cheshie cat". He'd have good reason too, because MARQUETTE'S quick, easy pickup and smooth, uninterrupted flow of matchless welding power prompts a satisfied smile and makes it easy to produce strong, uniform welds on sheet metal or the heaviest steel structures.

There's no "magnetic blow" to harass the operator. No confusing dials or gadgets to manipulate. Instantaneous heat selection and automatic voltage control assure perfect current for every job without questionable manual adjustment.

COMPLETELY EQUIPPED
Nothing more to buy.

BUY THE BEST . . . BUY MARQUETTE

LOW INITIAL COST • LOW COST OPERATION • NEGLIGIBLE UPKEEP • SIMPLE OPERATION and FAST, FLAWLESS WELDS • ALL ASBESTOS INSULATION • 10 SUPERB MODELS, 125 to 400 amps.

Send for free, 24 page, illustrated booklet.

MARQUETTE MFG. CO., INC.
Minneapolis 14, Minn.

MARQUETTE

a.c. arc welders

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UNITED

TUBES

Resistance welding is one application of the vacuum tube which demands not only the maximum degree of sustained thermal radiation, but great mechanical *ruggedness*. It's no job for a tube with a delicate constitution.

UNITED Tubes deliver the utmost, in both electronic efficiency and endurance. They stand up in long periods of service, under continuous vibration and shock. These tougher tubes are the preference of more and more welding engineers.

Engineers who are "from Missouri" are invited to prove every UNITED claim for themselves . . . under the most exacting working conditions. Next time you need tubes, put UNITED Tubes to the test. Let the comparison tell its own story.

Our local jobber in your city can obtain UNITED 972-A's for you on properly rated orders placed reasonably in advance of your actual needs. Order now—or write us direct.

UNITED ELECTRONICS COMPANY
NEWARK 2, NEW JERSEY

WHY UNITED TUBES GIVE LONG SERVICE

1. "Heavy duty" quality is emphasized in all component parts.
2. Extra care enters into all manufacturing and inspection steps.
3. The protruded filament surface is mounted on a vertical plane. This affords greater emitting area.
4. The large cylindrical member shields the filament adequately, and permits proper thermal radiation for extended service life.

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Charleston, W. Va.—Safety First Supply Co.
Chattanooga—C. D. Genter Co.
Chicago—Protective Equipment, Inc.
Cincinnati—The E. A. Kinsey Co.
Cleveland—Safety Clothing & Equipment Co.
Columbus, O.—The E. A. Kinsey Co.
Dayton—The E. A. Kinsey Co.
Denver, Colo.—E. D. Bullard Co.
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Grand Rapids—F. Ranville Co.
Greensboro, N. C.—Smith-Courtney Co.
Greenville, S. C.—Carolina Sup. Co.
Hickory, N. C.—Smith-Courtney Co.
Honolulu and Hilo—Theo. H. Davies & Co., Ltd.
Houston—E. D. Bullard Co.
Indianapolis—The E. A. Kinsey Co.
Jacksonville—Cameron & Barkley Co.
Kansas City—L. R. Stone Supply Co.
Los Angeles—E. D. Bullard Co.
Louisville—Neill-LaVielle Co., Inc.
Memphis—J. E. Dilworth Co.
Milwaukee—Protective Equip., Inc.
Muskegon—Factory Supply Co.
New Orleans—Woodward, Wight & Co., Ltd.
New York—W. S. Wilson Corp.
Oklahoma City—Hart Industrial Supply Co.
Omaha—Interstate Mach. & Sup. Co.
Philadelphia—Industrial Prod. Co.
Pittsburgh—Safety First Supply Co.
Providence—James E. Tierney
Richmond, Va.—Smith-Courtney Co.
St. Louis—Safety Incorporated
St. Paul—Farwell, Ozmun, Kirk & Co.
Salt Lake City—E. D. Bullard Co.
San Francisco—E. D. Bullard Co.
Scranton—L. B. Potter Co.
Seattle—E. D. Bullard Co.
Springfield, Mass.—Charles C. Lewis Co.
Syracuse—Syracuse Supply Co.
Tampa—Cameron & Barkley Co.
Troy, N. Y.—The Troy Belt & Sup. Co.
Tulsa, Okla.—Hart Ind. Supply Co.
Toronto—Safety Sup. Co.
Montreal—Safety Sup. Co.
Vancouver—Safety Supply Co.

GOGGLES • GAS MASKS • HELMETS • RESPIRATORS

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News of the Industry

Refrigerated Electrodes Tested and Prove Merit

That electrode life can be greatly prolonged, tip pick-up noticeably retarded and spot welding speeded by refrigeration under good welding conditions are the major disclosures of a recent investigation into the effects of coolant temperatures on spot-welding electrode performance. The project, sponsored by the Welding Research Council, was carried out under the direction of Dr. W. F. Hess, assistant professor in metallurgical engineering and head of the welding laboratory at Rensselaer Polytechnic Institute.

The investigation was limited to the welding of aluminum-clad sheets (Alclad 24ST) 0.040 in. thick. In each series of tests, welding was done as continuously as possible until the electrodes showed evidence of having been in use too long. Water-cooled electrodes of the conventional bored-cylinder type gave an average of 30 spots between tip cleanings. Refrigerated electrodes of the capped type gave more than 2,200 acceptable spot welds between cleanings. In testing the latter electrodes, a refrigerant temperature of zero F was found to be most economical for production purposes.

» «

Pullman-Standard Develops Ventilated Welding Mask

After more than a year of research, the medical and safety department of the Pullman-Standard Car Manufacturing Co. has developed a new-type welding mask which prevents sickness, including galvo fever, caused by welding fumes. The new device has been tested under severe conditions and found to afford complete protection, Dr. R. J. De Motte, Pullman-Standard medical director reports. It was developed as the result of research work conducted by Dr. L. R. Krasno of the physiology department of Northwestern University.

Basically, the mask consists of a compressed air unit which fits inside a standard weldor's hood and directs an outwardly flowing spray of air to surround the wearer's nose and mouth. The effects are threefold: (1) prevention of fumes from being drawn into the mask, (2) avoidance of drafts on the face and eyes and (3) prevention of sweating around the eyes.

"In the past 20 years we have been able to guard against the dangers of galvo fever by using forced draft ventilation when welding was done in the open shop," Dr. De Motte explained, "but our entry into war work necessitated welding in close quarters, deep in the hulls of warships, where efficient ventilation was difficult."

» «

Use Form WPB-1319 to Order Resistance Welding Machines

After March 15, Form WPB-2752 can no longer be used in applying for an authorization to purchase resistance welding equipment. Form WPB-1319 must be used instead, according to WPB General Limitation Order L-298 as amended Feb. 25, 1944. The amended order states:

"No manufacturer or dealer shall accept an order for, or deliver any new resistance welding equipment unless the order or delivery is specifically authorized by the War Production Board on Form WPB-1319....Application for an authorization, and for a preference rating if none has been previously assigned, is to be made by the purchaser by filing Form WPB-1319 with the War Production Board in accordance with the current instructions for the form. Applications on Form WPB-2752 will continue to be accepted by the War Production Board until March 15, 1944 only."

The delivery restrictions of the above paragraph do not apply to orders received prior to July 27, 1943.

» «

Jeep Engines Drive Welding Equipment

The jeep engine is being used by Army maintenance crews to drive arc-welding equipment, and this is only one of its many extra-curricular war uses. The four-cylinder power plant is also being used to operate radar, floodlights, short-wave radios, electrically driven tools, kitchen appliances and even ice-cream mixers, according to Ward M. Canaday, president of Willys-Overland Motors, Inc.

When adapted for marine use, the jeep engine propels small landing barges and lifeboats. In this service, it also drives heavy-duty underwater welders.

» «

White Star Awarded to United Electronics

In a letter from Under-Secretary of War Patterson, R. H. Amberg, president of the United Electronics Co., Newark, was informed that his company had been named to receive the White Star for the Army-Navy "E" Pennant awarded to it last August.

TORCH SLINGERS

Whose Hearts Belong to "Uncle"

A mighty big job these girls are doing for their "Uncle Sam", who represents their men in the armed services. And a mighty big job the Meco Aviator Torch is doing in those capable hands. The Aviator is a *precision* welding tool especially fitted for aviation work because Meco pioneering had the answer to precision welding long before war was thought of.

FOR YEARS aviation students at Parks Air College have been receiving their basic welding training with Meco Aviator Torches . . . as this six-year old photo shows.

The work of Uncle Sam's "Torch Slingers" is speeding the day when Meco Aviator Torches and all other Meco products will again be available to all—Give 'em a hand, folks!

The New Meco Catalog is available now—write for your copy.

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STULZ-SICKLES CO. NEWARK 5, N. J.

Stauss & Haas, Inc., New Distributor in New Orleans

Stauss & Haas, Inc., 524 Camp St., New Orleans 4, replaces the former Oliver H. Van Horn Co., Inc. Officers are: Edward F. Stauss, Sr., president; Edgar J. Haas, secretary-treasurer; Lieutenant Edward F. Stauss, Jr., vice-president, and Lieutenant Malcolm G. Haas, vice-president. Both vice-presidents are at present in the service of the U. S. armed forces.

The firm handles welding equipment, machine tools, machine shop supplies, industrial supplies and paint. Mr. Stauss, Sr., has been associated with small tools and wood- and metal-working equipment since 1904, and Edgar J. Haas since 1905. These two executives started as office boys at $2.50 per week and came up the hard way to their present positions. In December, 1939, they purchased the firm of Oliver H. Van Horn Co., Inc.

» «

McKinney Welding Supply New Distributor in N.Y.C.

The copartnership of Charles H. McKinney and Edward G. Fulton has been dissolved, and Mr. McKinney is continuing in the welding supply and equipment business under the firm name of the McKinney Welding Supply Co. Early in March, this firm moved to new and larger quarters at 446 West 54th St., New York City.

» «

S.S. Rebecca Lukens Named after Woman Industrialist

Ships are always considered to be of the feminine gender, but only 90 of them have been named after actual American women. One of these is the Liberty Ship *S.S. Rebecca Lukens*, launched last month at Panama City, Fla. This is the first ship to be named by the U.S. Maritime Commission for a woman industrialist.

The original Rebecca Lukens took over the management of the Lukens Steel Co. in 1825 and remained at the helm until shortly before her death. The company is still controlled and managed by her descendants, one of whom, Miss Ruth Huston of Hyden, Ky., was chosen to christen the ship with the name of her own great grandmother.

« »

Summer Management Course

A summer management course devoted to production planning, plant layout, motion and time study, wage incentives and related subjects will be held June 12 to June 30 at the College of Engineering, University of Iowa, Iowa City. This is an extensive course intended for plant managers, foremen, industrial engineers, time study analysts, cost accountants, office executives, etc., interested in comprehensive training in production planning, routing and scheduling, and related subjects.

★

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World's Largest Manufacturers of Stainless Electrodes

YORK, PENNSYLVANIA

Harnischfeger Establishes Separate Repair Division

Anticipating a growing demand for repair and replacement parts as a result of war production burdens on equipment, the Harnischfeger Corp., Milwaukee, has established a separate division for handling such business on all P&H products. The new Repair Sales Division is being managed by **J. D. Glatz,** former P&H representative in the Chicago area who has just returned to the company from Washington after two years with WPB as chief of the crane and hoist section of the tools division.

Products to be included under Mr. Glatz's division will include a-c and d-c welders, welding positioners, overhead traveling cranes, hoists, power shovels, crawler cranes, draglines, clamshells, etc.

» «

Heat Transfer Research Is Established at Purdue

A joint industry-education enterprise for the "intensive training of graduate students in exploring the field of heat transfer for data" has been established at Purdue University as the result of a $75,000 grant from the Westinghouse Electric and Manufacturing Co. The five-year training and research program will be directed by Dr. George A. Hawkins, a member of the Purdue faculty since 1930, who has been appointed Westinghouse research professor in heat transfer. Dr. Max Jakob of the Illinois Institute of Technology will collaborate with Dr. Hawkins as non-resident research professor.

» «

Stress Analysis Society Meets in Boston, May 18-20

The spring meeting of the Society for Experimental Stress Analysis will be held May 18, 19 and 20 at the Hotel Statler, Boston 17. The program will include a symposium on residual stresses, their measurement and effects. Inquiries should be addressed to the Society at P. O. Box 168, Cambridge 39, Mass.

No Finishing Job is Too Tough for
SKILSAW DISC SANDERS
• Model "SL"—Heavy duty power unit for a wide variety of surfacing operations. For use with 6 in. grinding wheels and wire brushes.
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SKILSAW PORTABLE ELECTRIC TOOLS
MAKE AMERICA'S HANDS MORE PRODUCTIVE

If you, as a reader, do not agree with our answers, let us know your thoughts. Your comments and discussions will be published, too.

Silent Arc

Q—What is meant when reference is made to a silent arc in the discussion of atomic-hydrogen welding?—*R. L. K.*

A—The term silent arc refers to a short arc having a voltage range of from 20 to 40 volts. This arc fails to have the characteristic hissing sound that is commonly associated with atomic-hydrogen welding. An arc of this type is usually used to obtain a point source of heat.

» «

Surface Checking

Q—What may be considered the cause for surface checking in connection with attempts to flame-harden railroad rails?—*G. H. M.*

A—Surface checking often develops as an aftermath of applying heat to the surface of alloy steel materials. The reason that checking tends to appear in railroad rails is because of the high carbon content of this material. Surface checking usually occurs following a quenching operation on high-carbon steels.

» «

Thermit Welding

Q—What are the steps required in making a thermit weld?—*L. B. W.*

A—There are generally considered to be nine steps involved in the making of a thermit weld. These steps are: (1) cutting out the fracture, (2) cleaning the parts, (3) lining up the parts, (4) making the wax pattern, (5) making the sand mold, (6) preheating, (7) preparing the charge of thermit, (8) igniting and (9) pouring the molten thermit mixture.

Postwar Plan?

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write for Bulletin No. 500

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"DALLETT" PNEUMATIC SAFETY RETAINER SHANK CHISELS

■ ■ *"DALWELD" DETACHABLE WELDING CABLE CONNECTORS* ■ ■

Electronic Welding

Q—What is meant by an electronic arc welder? On what electric principles does this type of welding equipment operate?—*V. I. W.*

A—The electronic welder is a low amperage arc welder designed for use in those operations where precise welding is required and the reduction of heat and the elimination of distortion in the welding of thin materials are desired. The electronic welder employs a polyphase rectifier circuit, using a rugged-cathode-type mercury vapor rectifier.

A very interesting and practicable control circuit has been applied to this type of arc welding. It consists of a saturable reacter which is regulated by a slide wire type of rheostat. This rheostat allows very minute changes in the output welding circuit. It also provides continuous stepless regulation of the output current so that precise regulation may be obtained.

» «

Stainless Steel Welding

Q—Can stainless steel be gas welded satisfactorily?—*R. F. M.*

A—Stainless steel can be gas welded quite readily providing sufficient care is taken to control expansion, which might cause a tendency towards warpage. This difficulty can be controlled by proper jigging or holding the material in restraining fixtures during welding. In welding stainless steels, it is usually advisable to paint the underside of the seam with a flux in order to prevent oxidation of the weld.

» «

Plastic Welding

Q—I have heard considerable discussion regarding plastic welding. Is it now possible to weld plastics?—*R. B. S.*

A—Plastic welding is a term sometimes used to describe those welding processes (also referred to as pressure-welding processes) such as forge welding, pressure thermit, resistance and pressure gas welding. The term "plastic welding process" does not refer to a means of welding plastic material but to a welding process wherein the metals to be welded are heated to a plastic stage and then forced together by external pressure to complete the weld.

» «

"Hot" and "Cold" Welding

Q—Experienced weldors, especially oldtimers, refer to a "hot" weld or a "cold" weld. What do they mean?—*G. E. N.*

A—A "hot" weld is an arc weld that is kept in a molten stage the full width of the bead during the weld. This type of weld should be used wherever possible. A "cold" weld is one that is not kept in a molten stage the full width of the bead. Instead, just enough heat is used to keep a small molten pool of metal at the end of the electrode, and this pool is carried from one side of the bead to the other by the arc.

» «

Machine Polarity

Q—How can the polarity of an arc-welding machine be determined?—*E. M. M.*

A—The simplest means of determining the polarity of the welding current is by means of the voltmeter on the welding machine. For those machines that are not equipped with a voltmeter, polarity may be determined by drawing an arc on a steel plate with either a bare metal electrode or a carbon electrode. If the electrode is negative, the arc will be quite stable. If the arc is wild or rather hard to hold, it can be assumed that the above condition is reversed; that is, the electrode is positive. When the electrode is positive, it will heat very rapidly.

» «

Welding Machine Adjustment

Q—It is usually practicable to adjust a welder according to the recommendations in the manufacturer's instructions. In some cases, however, it is found that the desired current may be secured from more than one setting. In such cases which setting should be used?—*E. A. S.*

A—The operator should select the current setting which will give the best welding performance. Welding performance with an arc welder should be considered from the points of view of arc stability, minimum sticking and minimum spatter, regardless of the kind of work to be done. When these conditions are met by a particular setting of the weldor, it will be found that the best welding performance will be obtained on any type or kind of weld joint.

Center Scope Brings Optical Precision to Machine Shop Operations

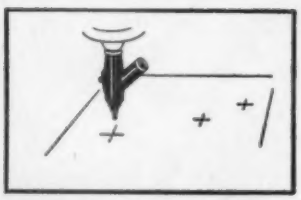
The Center Scope is an optical centering and locating tool that can be easily and quickly used on any machine to center work reference lines to a spindle axis. It permits accuracy to a degree never before obtainable, as the optical beam or line of sight is absolutely inflexible and cannot be distorted.

The Center Scope's easy accuracy eliminates many human errors, as the operator can see just what the cutting tool will do before it is actually fed into the work. It increases production, improves efficiency and prevents spoilage. There is no pressure on the work piece nor is it subject to wear or changes in temperature—for the Center Scope never touches the layout.

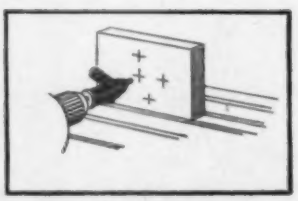
The Center Scope enables the operator to easily and quickly locate edges to a spindle axis, set-up faster and compensate for run-out. It saves vital hours in checking, inspecting and measuring when mechanical methods and tools are impossible to use. Its 45 x magnification allows operator to see ".001" and requires no technical knowledge or training to operate.

While there is nothing particularly new or ingenious about Wrigley's Spearmint gum, it is proving useful to millions of people in many new ways. Workers in war plants everywhere have found it helps keep them alert and relieves nervous tension and dry mouth while they are on the job.

You can get complete information from the Center Scope Instrument Company, 351 S. LaBrea Ave., Los Angeles, Calif., or Kearney & Trecker Products Corporation, Milwaukee, Wis.



ON A VERTICAL MILL—locating and centering height gauge or size block layouts. Permits jig borer accuracy on more machines.



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Y-109

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Automatic Welding-head Positioner — adaptable to your own holding fixture.

WRITE
for information relating to your particular welding fixture problem

How TO SPEED UP WELDING OPERATIONS!

Use This Dual Automatic Welding Fixture!

THIS Acme dual fixture arrangement permits practically constant use of an automatic welding head, because one of the fixtures can be reloaded while the other is engaged in the welding operation.

The holding machine can be set to revolve at any angle from vertical to horizontal. (Illustration shows a wheel being welded at 45° angle.) Positioner arm swings from one fixture to the other, locking in proper position. Speed of rotating the work is adjustable, as desired.

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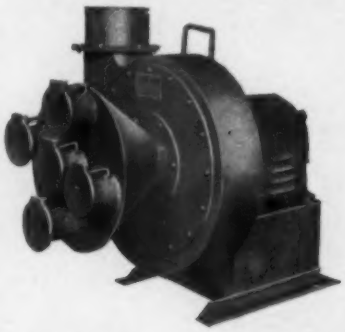

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For multiple hose connections in shop and field operations.

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For exhaust from booth collector ducts; and in the smaller units.

High Velocity Exhaustion by High Speed Centrifugal Fans for Small, Easily Handled Hoses

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Movable by crane hook or carrying bar; or for fixed (duct) service. ¾ to 15 motor horsepower.

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Self-closing caps on all nozzles.
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Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

"Piping Pointers"

This 32-page letterhead size manual was published to acquaint industrial maintenance men with the information they should have on valves and fittings. One of its most valuable features is a two-page definition section, "The Language of Piping," in which the most commonly used terms and their meanings are given. The definitions are supplemented with small photographic illustrations whenever pictures are necessary to convey the full meaning. Other sections of the manual cover: valve designs and how they operate; the range of pipe fittings; hints on handling valves, fittings and pipe; how to make up a screwed joint; how to make up a flanged joint; procedure for making up a solder joint; welded pipe joints; how to install a globe valve; what to do when valves leak, etc. The section on welded joints discusses briefly both butt-welded and socket-welded types of joints as well as the use of welding in joining flanges to piping. **Crane Company,** 836 So. Michigan Ave., Chicago 5.

» «

Victor Apparatus Bulletin

One of the most attractive looking pieces of sales literature to be released in many months is the 16-page, letterhead-size bulletin titled "A Presentation of Welding and Cutting Equipment by Victor." Eight four-color process illustrations (seven of them full-page size) display in their natural colors the various models of Victor welding torches, cutting torches, pressure regulators and related equipment. This booklet, Form 20, was designed to convey to the ultimate user a pictorial impression of the company's equipment. **Victor Equipment Co.,** 844-54 Folsom St., San Francisco 7.

» «

Welding Manganese Steel

A publication which fulfills a long felt need is "The Welding of 11 to 14% Manganese Steels," published by **Stulz-Sickles Co.,** 134-42 Lafayette St., Newark 5. This 20-page letterhead-size booklet gives welding procedures for welding with manganese nickel steel electrodes and also for using hard-facing electrodes. Applications discussed are the repairing and reclaiming of frogs and crossovers, bucket and shovel teeth, crusher plates, tractor grouser cleats, gyratory crusher mantles and roll crushers. A page of questions and answers clears up points which might not otherwise be fully understood by the reader. The uses of applicator (filler) bars and cast wedge bars are also covered.

» «

"Weapons that Win"

This is the title of an informative 24-page booklet published by **American Iron and Steel Institute,** 350 Fifth Ave., New York City 1. "Under ten flags American steel takes the offensive," the booklet introduces its dramatic story. "Whether by land, by sea, or across the skyways of the world, America's steel is hurling its more than 90,000,000 tons of productive capacity into the balance scales of war." The war uses of steel discussed include many with which the average reader is probably not familiar.

» «

Advertising for Workers

With our armed forces reaching out for more and more men, the problem of securing replacements has become one of the toughest that American industry faces. To help foundrymen to put a bit more punch and pulling power in their help-wanted ads, **Despatch Oven Co.,** Minneapolis, has brought out a useful folder, "How to Advertise for New Foundry Workers." Though "slanted" primarily for foundrymen, the tips given can readily be adapted by other industries. The copy was checked and approved by the U. S. Employment Service branch office in Minneapolis.

» «

Replacement Parts List

Prices on replacement parts for torches, regulators, acetylene generators and accessories are covered in detail in the newly published "Replacement Parts List No. 108" for Meco welding and cutting equipment. A copy can be secured from **Modern Engineering Co., Inc.,** 3401-15 Pine Blvd., St. Louis 3.

» «

Positioner Folder

The Metro vise positioner is the subject of a four-page, letterhead-size folder. This product is a small-size positioner on which a vise or fixture may be mounted (see page 76, February, THE WELDING ENGINEER). **Metro-Vise Co.,** 6560 Cass Ave., Detroit 2.

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Here is a 12-ton laboratory type hydraulic unit suitable for duplicating conditions of actual production (10,000 lbs. per square inch pressure) . . . Comes complete, with extrusion die-head . . . Ready to set on your floor, connect to your power line and start producing . . . Hydraulic and electrical controls at operator's fingertips . . . Welded steel construction . . . A smooth-working, efficient unit . . . Can be delivered in twelve weeks under proper priorities . . . Full information on request.

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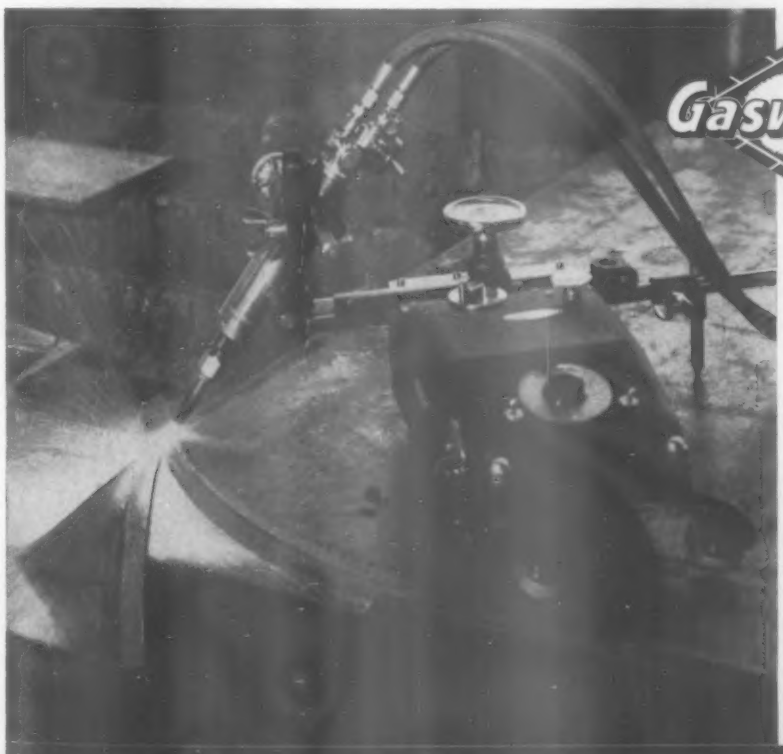

Gasweld

G-W PORTABLE FLAME CUTTING MACHINE

● The "Gasweld" G-W Flame Cutting Machine is a portable, motor driven torch for cutting billets and straight lines, strips, circles, arcs or simple irregular outlines in steel plates. Either straight or beveled edge cuts are easily made.

Cuts can be made clean and accurate, eliminating in many cases, the need for further machining. Light, compact—weighing only 45 pounds—the machine is easily moved from place to place in the shop. Speed range—four to sixty inches per minute; travels either forward or in reverse direction.

The G-W Portable Flame Cutting Machine effectively lowers cutting costs and speeds production over hand-cutting methods.

Write for illustrated bulletin and price to

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WALL CHEMICALS DIVISION of
The Liquid Carbonic Corporation
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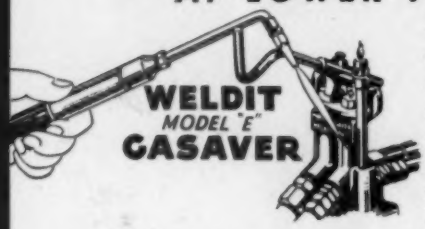
Safe Welding

AT LOWER PRODUCTION COSTS



The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

When the Weldit Gasaver has been installed, you simply hang idle torch on the handy lever rod. Weight of torch pulls rod down, thus automatically shutting off supply lines. Relight instantly by passing torch over Gasaver pilot light. No bother. . . . No time lost. . . . *No readjusting required.* . . . Price $10.00 at Detroit. Order today.

Better Soldering, Annealing and Heating Jobs

The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, manufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

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"JORGENSEN"
Extra Quality
Series 820 Welders
Heavy Frame Deep Throat with Crank or Bar Handle with or without Shielded Screw.
A large variety of others to choose from
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Ask for Them by Name

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"The Clamp Folks"
426 N. Ashland Ave., Chicago, (22), U. S. A.

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HARNESS THE 4 ADVANTAGES
YORK'S 77 CAST IRON BRAZING FLUX
TO SALVAGE CRITICAL MATERIAL AND GREATLY INCREASE PRODUCTION ALL ALONG THE LINE

1. Fear of overheating can be forgotten.
2. Cleaning and grinding are unnecessary with "York's 77". Send for FREE Sample.
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4. Deteriorated cast iron can be welded with "York's 77".

YORK ENGINEERING COMPANY • 3349 OGDEN AVENUE CHICAGO ILLINOIS

Valve Selection Chart

Valve selection made easy is the theme of an 11½ by 17 in. chart that is printed on heavy cardboard for tacking up in the shop. To aid in determining the right valve for a particular job, the chart gives a simplified breakdown of five basic conditions—what fluid, what temperature, what pressure, what size and what is the valve to do. **Reading-Pratt & Cady Division of American Chain & Cable Co., Inc.,** Dept. S. P., Bridgeport, Conn.

» «

Flexible Shafting Booklet

"The How and Why of Flexible Shafting" is the title of a new 36-page, letterhead size booklet published by the Stow **Manufacturing Co.,** Binghamton, N. Y. Drawings and photographs picture the construction of core, case and fittings and depict how flexible shaft assemblies are used to get around obstacles, to connect parts with relative movement, and to eliminate miter gears, spur gears, universal joints, etc.

» «

Manganese Steel Bulletin

Bulletin No. 244-P in the series of Amsco booklets being published to depict the uses of manganese steel in the country's basic industries bears the title, "Manganese Steel for Oil Field Service." The applications described in the 16 pages of this booklet include sprocket wheels, drill stem bushings, sheaves for wire rope, crown and casing block sheaves, crown and traveling blocks, centrifugal pumps, etc. **American Manganese Steel Division,** American Brake Shoe Co., Chicago Heights, Ill.

» «

Electronic Control Bulletin

A two-page folder (Technical Bulletin No. 75-51-50) just issued by **Weltronic Company,** 20735 Grand River Ave., Detroit 19, gives features, specifications and functions of the Weltronic synchronous resistance-welder control, Model No. 75-51-50. This particular model is fully automatic, all electronic and continuously adjustable; it was designed to permit complete control of operations on spot welders that use air or hydraulically actuated electrodes with solenoid-operated valves.

» «

Postwar Planning Folder

The A B C's of a practical postwar planning program are summarized in a six-page folder prepared by the Policyholders Service Bureau of the **Metropolitan Life Insurance Co.,** One Madison Avenue, New York City 10. This study briefly discusses the necessary steps of: *(a)* establishing the objective, *(b)* assigning the responsibility, *(c)* defining the scope, *(d)* developing the facts, *(e)* setting up a timetable, *(f)* preparing a formal plan, *(g)* implementing the plan, and *(h)* getting started.

FOR WELDERS ON EXPOSED JOBS!

the M·S·A COMBINATION SKULLGARD-WELDING SHIELD

This practical combination benefits today's welders in shipbuilding, steel, oil, construction, and all other industries where head hazards, bumps and falling objects are encountered. Combining the safety of a laminated bakelite cap-type Skullgard for proved head protection with a one-piece welding shield of tilting design, better comfort and efficiency is assured on the job. The welding shield has a leak-proof lens holder—the Skullgard cap can be worn separately for other work when desired. Ask for Bulletin No. CE-9!

MINE SAFETY APPLIANCES COMPANY
BRADDOCK, THOMAS AND MEADE STREETS · PITTSBURGH, PA.
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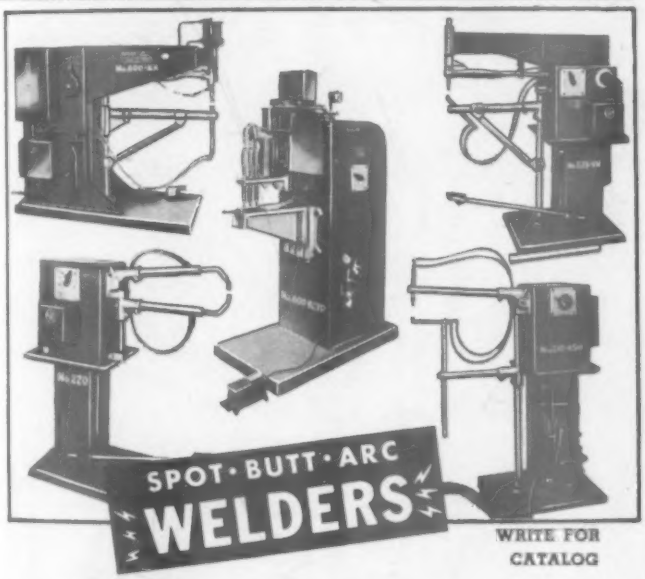

WRITE FOR CATALOG

We manufacture a complete line of resistance spot welders from ¼ to 300 KVA for all types of welding. There is an EISLER WELDER for every purpose.

TRANSFORMERS OF ALL TYPES

WE INVITE CONTRACT SPOT WELDING IN LARGE OR SMALL QUANTITIES.

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CANADIAN RADIUM REVEALS FLAWS INSIDE STEEL, BRASS, BRONZE CASTINGS ½ TO 10 INCHES THICK

The power of radium's Gamma-rays to penetrate solid metals up to 10 inches in thickness, and the ease and simplicity of radium radiography, make it ideal for detecting internal defects in thin metal sections too!

With remarkable detail, radiographs locate and clearly identify all types of internal flaws. A batch of small, thin sections can often be recorded in a few minutes in a single exposure.

All the equipment required is a capsule of Canadian radium (you can rent or buy) and a supply of films. No power, no attachments, no repairs, no "servicing." Investigate this essential aid to efficient production—Now.

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Reliable, profusely illustrated 80-page textbook on the fundamentals and technique of modern Industrial Radiography of Metals with Radium. Specially prepared for the metals industry by our research and technical staff. Write for your copy today, giving your name and company position.

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630 FIFTH AVE., ROCKEFELLER CENTER, NEW YORK 20, N.Y.

Grinding Wheel Folder

A four-page letterhead-size folder is devoted to Norton's "57 Alundum" grinding wheels, which were recently made available for general production uses (see page 86, March, THE WELDING ENGINEER.) Illustrations show applications of these wheels to cylindrical and centerless grinding, internal grinding and snagging. Samples of performance reports are reproduced on the final page. **Norton Company**, Worcester 6, Mass.

» «

Grinding Safety Booklet

The causes and means of avoidance of the accidents which occur in grinding are fully covered in "Grinding Wheels," the National Safety Council's Safe Practices Pamphlet No. 13. This 16-page letterhead-size booklet begins by discussing the meanings of the terms "grinding wheels," "abrasive wheels," "cutting wheels," etc., then takes up the causes of accidents and various protective devices. There are many tables to summarize such data as causes of abrasive wheel accidents, minimum diameter of spindles for wheels of various diameters and thicknesses, dimensions for flanges, dimensions for peripheral and side members of protective hoods, etc.

A slight charge will be made for this booklet if the person requesting it is not employed by a company member of the **National Safety Council, Inc.**, 20 North Wacker Drive, Chicago 6.

» «

"Imagineering" Notebook

"Imagineering" is defined as "the art of letting your imagination soar and then engineering it down to earth." As a stimulator of this mental process, there is offered the 28-page letterhead-size "Aluminum Imagineering Notebook." This booklet gives many illustrative examples of things that have been "imagineered" into aluminum actuality. All of these examples are based on one or more of the 12 economic advantages of aluminum, which are thumb-tabbed for the reader's convenience. **Aluminum Company of America**, Gulf Bldg., Pittsburgh.

» «

Folder on Steel Hardening

The uses of "Steel-temp" steel hardening solution are discussed in a 4¼ by 8¾ in. folder published by **Steeltem Chemical Co.**, 51 East 42nd St., New York City. When used for quenching, this solution is said to harden tools without drawing their temper, thus imparting an added toughness. The product, it is stated, can be used with either water- or oil-quenching steels.

EDCO Center Grip

PHOSPHOR BRONZE ELECTRODES

★ FOR ALL TYPES OF BRONZE ARC WELDING, USED EXTENSIVELY BY: Railroads, Refineries, Shipyards, Chemical Industries, Utilities, Welderies and Manufacturing Plants, for fabricating or building up worn bronze propellers, condenser tubes, valves, etc. Welding tool steel, bronze or copper fittings, supports, etc. to steel. Recommended for applying an overlay on steel to provide a non-seizing surface.

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ABOUT PEOPLE

E. W. Potratz has been appointed manager of the hoist sales division of the Harnischfeger Corp., Milwaukee. His charges include the four classes of P&H hoists: "Handi-Lift," "Zip-Lift," "Hevi-Lift" and "Trav-Lift" cranes. Mr. Potratz joined the Harnischfeger hoist division as an estimator in 1935 and was named assistant manager in 1939.

» «

Another Harnischfeger man, **Frank J. Hirner**, has been appointed to the post of St. Louis district manager. Mr. Hirner has had a long career with Harnischfeger Corp. Most recently, he was associated with the company's Chicago branch as a specialist on the welding of air-hardening steels. His new address will be 4030 Chouteau Ave., St. Louis.

» «

Philip H. Clapp has been appointed abrasive division district manager for the Pacific coast by the Norton Company, Worcester, Mass. He will make his headquarters in Los Angeles. Mr. Clapp is succeeded as Detroit district manager for Norton by **Donald L. Price**, who has been located in the Detroit district since 1926 as field engineer and abrasive engineer.

POSITIVE ARC
A.C. Arc Welder

DOES EVERY TYPE OF

WELDING

Built-In High Frequency Circuit Strikes Arc Easily With 1 or 100 Amperes!

Right now, in scores of huge industrial plants, POSITIVE ARC Welders are meeting the demand for high quality welding at low operating cost, plus 24 hours a day service. Here's a rugged, highly efficient welder — with features found in no other welding equipment. It is simple to operate, dependable and safe, and will do a better and faster welding job.

Available in 4 sizes
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QUALITY
THROUGHOUT THE WORLD

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Cast
Welding Rods

Cast Aluminum Welding Rods
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Plain and alloyed Gray Iron
Welding Rods and Electrodes

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Dependable Since 1897
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JONES Abrasive Belt SWING GRINDER

GETS IT SMOOTHER FASTER!

- High Speed Cutting
- Smooth, Even Surface
- Uninterrupted Grinding
- Easy to Install and Operate
- Quick Abrasive Belt Change
- Perfect Balance at Any Angle
- Reduces Time and Cost

You speed up your weld grinding three to six times with the Jones Abrasive Belt Swing Grinder.—And you get a smoother, more even surface.

It's easy to grind and finish with the Jones Swing Grinder, using quick-change, fast-cutting, economical abrasive belts. All controls are handy to the operator. This portable grinder is readily mounted for covering large work areas.

Get the details now on easy, smooth, high-speed grinding. Jones also makes Bench Grinders, and equipment for all types of grinding and polishing work.

WRITE TODAY FOR JONES SWING GRINDER BULLETIN

JONES ENGINEERING CO.
DEPT. C-1
ELLWOOD CITY, PENNA.
Abrasive Belt Grinding Specialists

William E. Paris has been appointed operating manager in charge of manufacturing at Willys-Overland Motors, Inc., Toledo. For the past two years, he has been assistant operating manager in charge of manufacturing.

» «

Walter S. MacNabb, who has been a steel man since 1907, was recently appointed division superintendent of the blast furnaces of the Gary Works of the Carnegie-Illinois Steel Corp., with which plant he has been associated since 1910. In addition to helping to develop the "world's largest steel mill," Mr. MacNabb also spent several years in India with the Tata Iron & Steel Co. plant at Jamsphedpur. He was closely associated with the late John Keenan, manager of the Tata plant and author of the recently published book, *Steel Man in India.*

» «

Lloyd C. Smith, formerly with Nicholson File Co., has taken a sales position with Heller Brothers Co., Newark.

» «

William D. Turnbull, formerly vice-president and sales manager of the Pomona Pump Company of California, has returned to Westinghouse Electric and Manufacturing Co. as manager of the agency and specialties department. Before joining the Pomona Pump Co. four years ago, Mr. Turnbull was manager of the Westinghouse machinery electrification section.

» «

Neil C. Hurley was recently elected chairman of the directors of the Independent Pneumatic Tool Co., and **Neil C. Hurley, Jr.,** was elected president. The younger Mr. Hurley has been associated with the firm for twelve years, serving successfully as manager of the electric tool division, secretary, vice-president and executive vice-president.

» «

Fred T. Goes was elected president and **William B. Vilter** vice-president during the recent annual meeting of the board of directors of the Vilter Manufacturing Co., Milwaukee 7. Mr. Goes has been active in the refrigeration and air conditioning field for many years. Since starting his career with Vilter in 1915, he has filled successively the positions of estimator, sales engineer, plant engineer, comptroller, secretary and vice-president and works manager.

» «

Arthur J. O'Leary has been appointed assistant manager of sales of Lukens Steel Co., Coatesville, Pa. He has been with Lukens since 1926 except for a period from 1941 to 1943 when he was "loaned" to the steel division of WPB. **George W. Eshleman,** who has been with the Lukens sales department since 1935, has been appointed assistant to the manager of sales.

» «

Pinkney W. Love has been appointed manager of the Washington, D. C., office of the Lukens Steel Co. at 911 Investment Trust Bldg., Washington 5. He succeeds **Charles A. Carlson,** who is resigning in order to establish his own business as an internal combustion engine manufacturer.

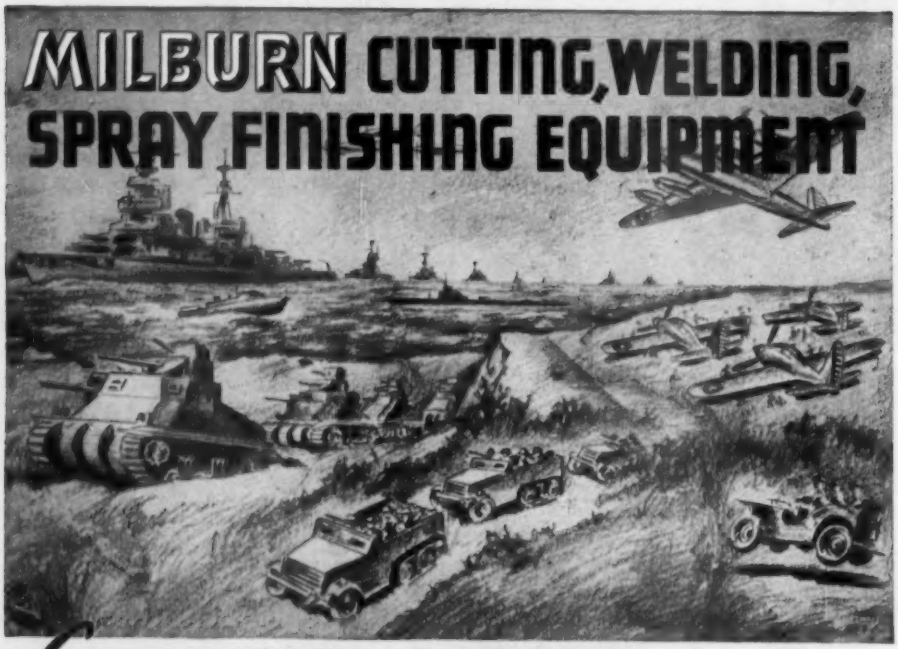
» «

William E. Harrison, formerly mill fuel engineer, has been appointed assistant fuel engineer for Lukens Steel Co. and its subsidiaries, By-Products Steel Corp. and Lukenweld, Inc.

» «

Died . . .

Jesse Jay Ricks, chairman of the board of Union Carbide and Carbon Corp., died at his home in Plandome, N. Y., on February 20, 1944, after a brief illness. He was 64 years of age. Mr. Ricks became chairman of the board of Union Carbide in 1941, after he had been president from October, 1925, to May, 1941. He is directly responsible for the liberal policy of research instituted nearly twenty years ago, which policy has borne fruits in the growth of the company's many interests.



Geared for **WAR** *today —or* **PEACE** *tomorrow*

Through two wars and for almost half a century, The Alexander Milburn Company has been serving Government and Industry. Milburn Equipment may be relied upon for superior, dependable service under stress of the most adverse conditions.

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C-F POSITIONERS

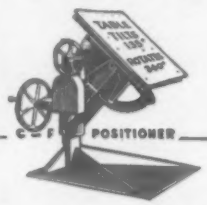
Save 72 Lifts

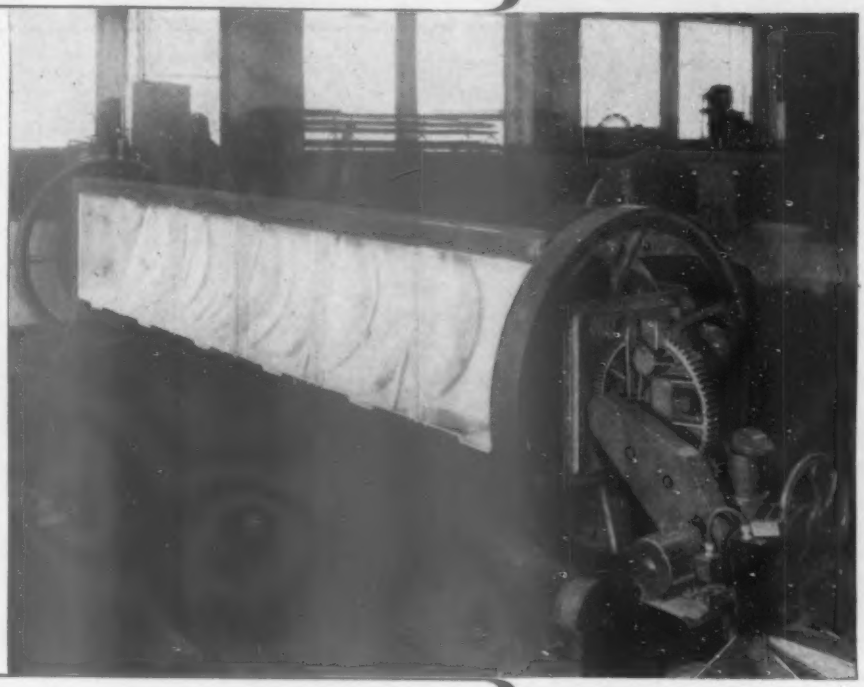
The Norberg Manufacturing Co., Milwaukee, has eliminated 72 lifts per unit by using a C-F Positioner on the production job illustrated. These complex weldments (Scavenging air headers for large Diesel engines) have to be "procedure-welded" and formerly required 72 crane lifts which took an average of 20 minutes apiece.

Now, the C-F Positioner moves the weldment through the routine positions under a push button control saving 24 hours crane time, 24 hours crane operator's time, and the same of both a sling man and the welder's time per weldment . . . in other words saving three man-days and one crane-day on each header produced.

C-F Positioners come in 6 sizes — capacities to 30,000 lb. All are pedestal mounted, rotate 360° and tilt to 135° beyond horizontal.

Write for Bulletin WP-22





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No. "300" ELECTRODE HOLDER

FIRST TO GUARANTEE
100% Insulated— Electrodes Used to BUTTS

★ **NO CLAMP HANDLE—NO SPRINGS**
Nothing to interfere with workers or get out of order to cause delays.

★ **SOLDERLESS CABLE CONNECTOR**
Permits quick detach of holder from cable, no time wasted.

★ **ONE MODEL—300 AMPHERES**
For universal work taking smallest electrodes up to 5/16 in. inclusive.

★ **BALANCED—LIGHT WEIGHT—STREAMLINED**
For greater efficiency, more work, less fatigue.

★ **AUTOMATIC LOCKING BARREL**
Stub can be removed with one hand and electrode replaced in a jiffy.

Distributors Wanted for All Territories!

CHICAGO TOOL AND ENGINEERING CO.
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Good Goggles are Essential

Meeting all Federal Specifications
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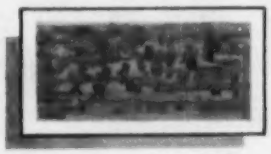
CONSTANTLY CLEAR VISION
with Thermacote
WELDING Lenses

25 to 1
ADVANTAGE

Thermacote special plastic coating (not a lacquer) sheds weld spatter. The welder has clear vision ALL the time. Better welding, more footage, no lost time for lens changing.



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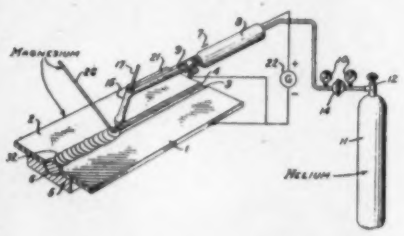
PORTLAND, OREGON

420 SOUTH SAN PEDRO ST.
LOS ANGELES, CALIFORNIA

FROM THE PATENT OFFICE

Inert-Gas-Shielded Arc Welding

2,342,086. **Russell Meredith,** Los Angeles, assigned to **Northrop Aircraft, Inc.** Filed Jan. 14, 1943. Issued Feb. 15, 1944.



A method of arc welding magnesium or other metal having similarly low temperatures of sagging, ignition and melting. The arc is struck and maintained between a refractory metal electrode and the adjacent edges of the parts being welded. The electrode, of tungsten or the like refractory metal, is conductive but substantially infusible at arc temperature. The arc and the molten weld metal are surrounded with a flowing stream of at least one chemically inert gas selected from the group consisting of helium and argon.

» «

Stud Welding Gun

2,342,144. **Grover A. Hughes,** Seattle, Wash., assigned one third to **Robert W. Hughes** and one third to **Roger G. Hughes,** both of Seattle. Filed March 29, 1943. Issued Feb. 22, 1944.

A gun for arc welding a stud to a plate. The stud forms one electrode of a welding circuit, and the plate forms the other electrode. Chief elements of the gun are a stud holder, yielding means acting thereagainst to press the stud against the plate and an electrically energizable means for moving the stud holder to lift the stud from the plate and thus create a welding arc. The arc-initiating current is applied on a circuit including the stud and plate while they are in contact, and the stud is then lifted for a timed interval. The welding current is applied to a circuit including the stud and plate while they are being held out of contact. After the proper interval, the arc-initiating circuit is opened, immediately bringing the stud and plate into welding contact. The welding current circuit is then opened as a final step in the operation.

» «

Copper-Nickel-Lead Rod

2,342,608. **Louis C. Dodd,** Buffalo, N. Y., assigned to **Magnus Metal Corp.,** Chicago. Filed April 2, 1941 and May 13, 1943. Issued Feb. 22, 1944.

A welding rod of an alloy containing 0.10 to 20.0% lead, 0.10 to 6.0% nickel, impurities not to exceed 0.20% and the balance copper.

Spatter Preventive

2,343,158. **Frank W. Scott,** Minneapolis, assigned to **Marquette Mfg. Co., Inc.,** Minneapolis. Filed Jan. 12, 1942. Issued Feb. 29, 1944.

A spatter preventive and cleaning shield for arc welding. It contains asbestos, bentonite, borax and graphite, these ingredients being mixed with sufficient water to form a slurry of paint-like consistency.

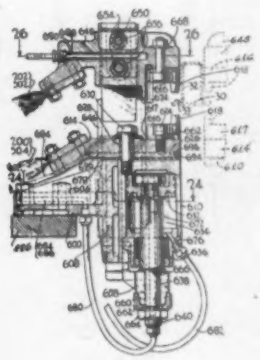
» «

Acetylene Generator

2,343,185. **Andrew Clifford** Holm and **Eddie Poirier,** Shawinigan Falls, Quebec, Canada, assigned to **Shawinigan Chemicals Limited,** Montreal, Canada. Filed March 16, 1942. Issued Feb. 29, 1944.

A process of producing acetylene and lime hydrate by the reaction of calcium carbide and water. A charge of calcium carbide and liquid are fed together into a generating chamber where they mix to cause a rapid chemical reaction. As a result of this reaction, acetylene is generated, and there is formed in addition a substantially uniform wet mass of liquid calcium carbide and lime hydrate. This mass is allowed to build up to a predetermined level, and is then continuously removed to another chamber away from contact with the incoming charge. Without further addition of carbide or liquid, the removed portions are agitated to react the remaining carbide and to dry the hydrate. The feed of the liquid and carbide is regulated to control the moisture content of the hydrate to within predetermined limits.

» «



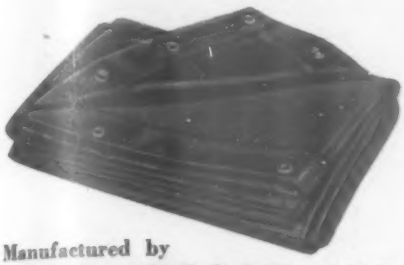
Welding Gun

2,341,133. **William A. Weightman,** Philadelphia, assigned to **Edward G. Budd Mfg. Co.,** Philadelphia. Filed Aug. 25, 1939. Issued Feb. 8, 1944.

A method of supporting a spot-welding gun independently of the work to insure freedom of floating to the opposing electrodes when the gun's center of gravity is below the work. After the upper electrode has been lowered into contact with the work, the weight of the gun is transferred from its support to the upper electrode and work. Simultaneously, the lower electrode is raised into contact with the work, and both electrodes are pressed uniformly against the work to exert a welding pressure.

JESSAR'S "SAF-T" CURTAINS

for Welding Plants and Industrial Uses



Made of fine quality, heavy duck.
Any size required.
Equipped with grommets ready to hang.
Color: Olive Drab.

Write for prices of the sizes that are needed.

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WATER-REPELLENT

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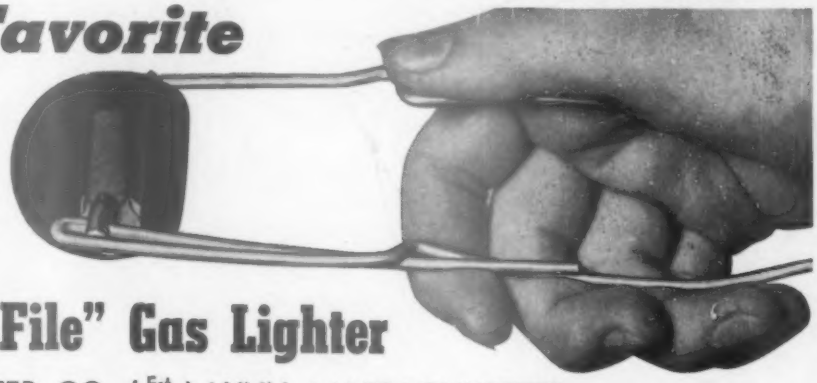

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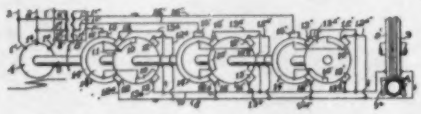
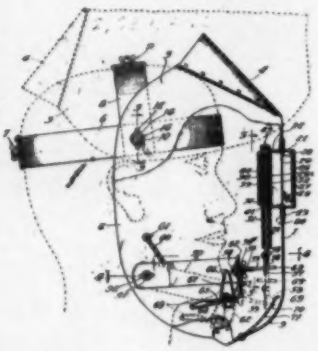
Tube Welding Apparatus

2,339,795. **Howard I. Morris,** Lakewood, O., assigned one-third to **Carl M. Yoder** and one-third to **Harvey O. Yoder,** both of Lakewood. Filed Jan. 21, 1941. Issued Jan. 25, 1944.



An apparatus for seam welding tubing which includes a three-phase step-down transformer with a-c supply mains connected to the primary windings and leads connected to the secondary windings. D-c mains are connected to the rotatable electrodes engaging the work; a current-reversing means is interposed between each lead and the d-c mains for connecting the lead alternately to the d-c mains during the reversal of current.

» «

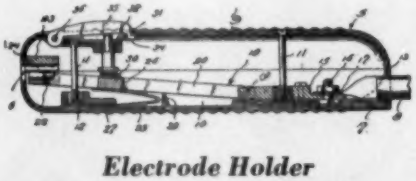


Weldor's Helmet

2,339,280. **Harold Roy Madson,** Glen Ellyn, Ill., assigned to **Welding Apparatus Co.,** Chicago. Filed Sept. 13, 1941. Issued Jan. 18, 1944.

In a weldor's helmet, a chin-operated means for opening and closing the lens. This includes a bow-shaped lever having its ends pivotally connected to the side walls of the shield that carries the window for the lens. To the mid-section of this lever, located forwardly of the operator's chin, there is secured the lens-actuating element. A chin-engaging member is connected to the lever for operating the lens upon the lowering of the chin. A spring is connected to a side wall and to the bow-shaped lever in order to hold the lever normally in an upper position.

» «



Electrode Holder

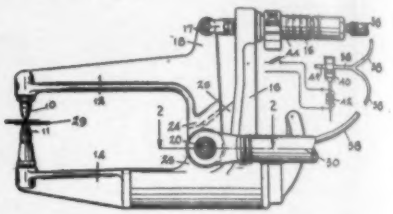
2,338,913. **Joseph John Esposito,** Washington, D. C. Filed Feb. 10, 1943. Issued Jan. 11, 1944.

In this holder, a hollow elongated hand grip of insulating material is provided at one end with openings to receive the welding electrode. At the other end is an opening to receive a feed cable with a frictional fit. A relatively fixed jaw is mounted in the grip and provided with grooves aligning with the openings previously mentioned. A spring-influenced movable jaw has grooves matching the grooves of the fixed jaw, the two sets of grooves coacting to receive and grip the electrode. The movable jaw is electrically connected to the feed cable.

» «

Spot-Welding Gun

2,341,459. **William H. Martin,** Pleasant Ridge, Mich., assigned to **Progressive Welder Co.,** Detroit. Filed Feb. 19, 1940. Issued Feb. 8, 1941.



In this patent, spot-welding electrodes are mounted on a frame and actuated between work-engaging and released positions. The frame is pivotally mounted relative to at least one of the pair of conductors completing the circuit to the electrodes. Coöperating with the mounting and operable by the actuating means is a means for selectively clamping or unclamping the frame with respect to the one conductor. When clamped, the conductive surfaces are urged together.

» «

Abrasive Wheel

2,343,218. **Robert H. Lombard,** Worcester, Mass., assigned to **Norton Co.,** Worcester, Mass. Filed Jan. 22, 1942. Issued Feb. 29, 1944.

A method of making a vitrified-bonded abrasive wheel by firing a mix of abrasive grains and a bond mixture. The latter includes at least two powdered borosilicate glasses— a low fusing, low silica glass having a silica content of between 45 and 68% and a high fusing, high silica glass having a silica content of 70 to 96%. During the firing, the low silica glass provides a fluid glassy matrix of low viscosity to wet the abrasive grains, while the high silica glass serves to increase the viscosity and thereby prevent deleterious shrinking and slumping during maturing.

» «

Brazing Flux

2,344,195. **Harry L. Anthony** and **James C. Turnbull,** Pittsburgh, assigned to **Scaife Co.,** Oakmont, Pa. Filed March 3, 1943. Issued March 14, 1944.

A brazing flux that is the reaction product of a neutral alkali metal fluoride, alkali metal tetraborate, boric acid and water in amounts such that an endothermic (heat-absorbing) effect occurs upon mixing them. After the occurrence of this effect, the composition is then heated to produce a paste.

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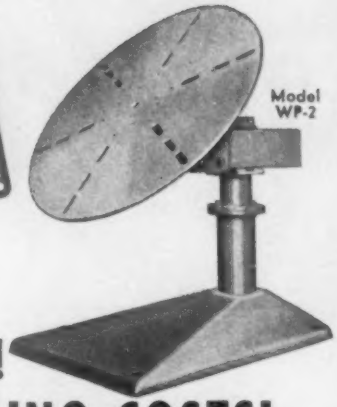

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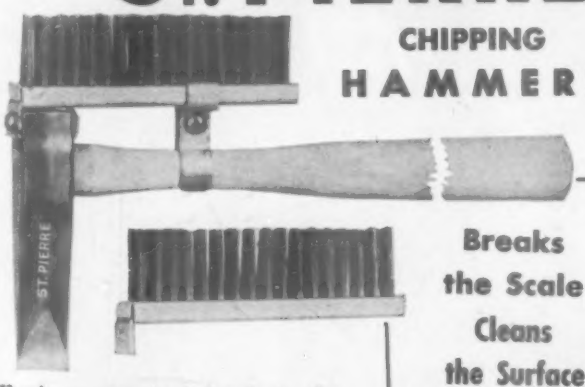

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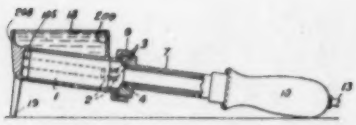

Electric Soldering Iron

2,341,938. **Ervin Mestitz,** Llandaff, Cardiff, Wales. Filed Oct. 23, 1942 (in Great Britain Oct. 3, 1941). Issued Feb. 15, 1944.

An electric soldering device comprising a cylindrical heating element, a holder, a tubular housing for the holder, a two-part coupling for electrically connecting and mechanically supporting the heating element, a handle and a removable housing for the cylindrical heating element. A mandrel is attached within the latter housing and extended within the heating element, while an elongated cup-like reservoir is provided for storing a supply of soldering material.

» «

Soldering Iron

2,344,196. **Joshua Attias,** New York City. Filed Jan. 16, 1942. Issued March 14, 1944.

A gas-heated soldering iron comprising a tube having an inlet section and a burner section of smaller diameter. These two tubular sections are disposed in axial alignment and have their inner ends connected together. A handle surrounds and is secured to the inlet tube section, and a cylindrical casing with a nipple portion at one end is threaded to the inlet tube. The other end of the casing is open and terminates in a plane short of the outer end of the burner tube section. Air inlet openings are provided in the casing. The soldering bit has a combustion chamber opening through its inner end. The burner tube section extends into the combustion chamber. Soldering bit has combined peep and exhaust openings.

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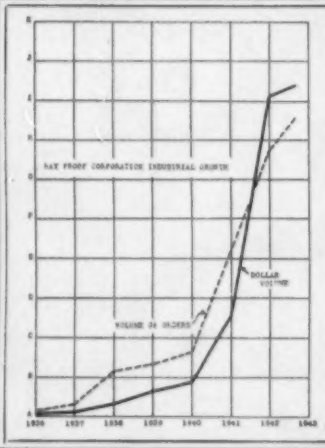

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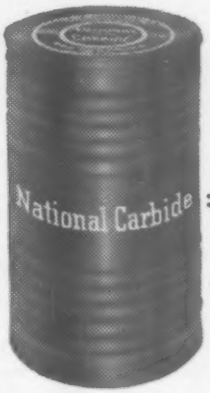

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Weldor's Mask or Helmet

2,343,864. **Edward S. Hebeler,** Williamsville, N. Y., assigned one half to **Unit Rays, Inc.,** Cleveland. Filed March 26, 1942. Issued March 14, 1944.

A weldor's mask or helmet having a vision opening, a glareproof shield mounted at the rear of this opening and movable upwardly and downwardly, a spring connected to the shield, a latch carried by the shield and a keeper for the latch. Spring tends to move the shield upwardly into registration with the sight opening. The keeper is spaced below the latch when the shield is in registration with the opening and adapted to be engaged by the latch when the shield is in its lowered (out of registration) position. A resilent latch-releasing member is arranged in proximity to the latch when the latter is in engagement with its keeper; movement of the wearer's chin presses this member against the latch to release it from engagement with the keeper.

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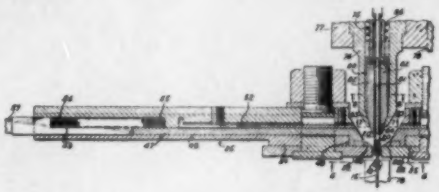
Spot Welder

2,343,687. **Frank Martindell,** Western Springs, Ill., assigned to **Western Electric Co., Inc.,** New York City. Filed Sept. 4, 1942, and Jan. 9, 1943. Issued March 7, 1944.



In a spot-welding machine, a pair of electrodes mounted for oscillatory movement toward and away from each other, a switch spring positioned and supported between the two electrodes, and a means for advancing simultaneously and in spaced parallel relationship two continuous strips of sheet metal to be welded. As the electrodes move toward each other, the end portions of the metal strips are clamped to opposite sides of the switch spring.

» «

Spot-Welding Apparatus

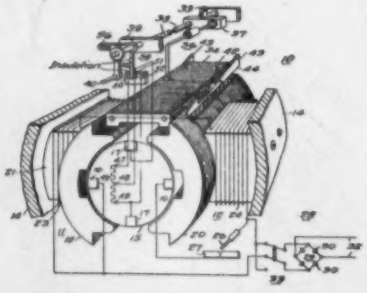
2,343,998. **Raymond E. Powell,** Westfield, N. J., assigned to **Western Electric Co., Inc.,** New York City. Filed Dec. 5, 1942. Issued March 14, 1944.

A spot welder with one electrode having normally spaced leading and following members. The leading member has a flat work-engaging surface and is free of engagement with the following member during movement of both members toward the surface of one of the parts to be welded. While the two members engage the first part, a second electrode engages the other part to be welded.

» «

Arc-Welding Generator

2,342,720. **John H. Blankenbuehler,** Edgewood, Pa., assigned to **Westinghouse Electric & Mfg. Co.,** East Pittsburgh, Pa. Filed May 10, 1941. Issued Feb. 29, 1944.



A generator comprising a pair of oppositely positioned field poles having field windings and an armature having main and auxiliary brushes. The main brushes are positioned along the axes of the field poles, and auxiliary brushes are positioned along an axis right angles thereto, at substantially the points of maximum potential produced by the field-winding flux. An adjustable magnetic shunt is positioned between the field poles to vary the magnetic leakage flux and thus vary the output of the generator. An impedance adjustable to different predetermined fixed values independently of the load current is connected between the auxiliary brushes and coöperates with the shunt member to produce different predetermined ratios of short circuit current to load current.

» «

Rod for Armor Plate

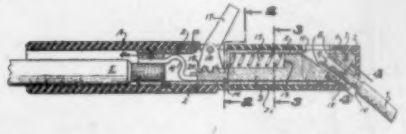
2,343,643. **Arthur T. Cape,** Santa Cruz, Calif., and **Charles V. Foerster,** Canton, O., assigned to **Coast Metals, Inc.,** Canton. Filed July 16, 1942. Issued March 7, 1944.

This rod for welding armor plate consists of a ferrous alloy containing from 0.50 to 1.50% carbon and chromium and nickel in amounts of from about 3 to 12% each.

» «

Electrode Holder

2,340,496. **Theodore R. Sweet,** Richmond, Calif. Filed Sept. 18, 1942. Issued Feb. 1, 1944.



An electrode holder with an insulated metal casing which is rectangular in cross section and encloses a pair of gripping members: one stationary and one movable, the latter having inclined parallel, adjacent gripping faces. The casing has top and bottom apertures in line with the spacing between the gripping members, through which apertures a welding rod may be inserted and gripped. The faces of the grippers are provided with copper contacts, and the movable gripper has a sliding fit in the casing. An expansion spring acts against this gripper and against an inwardly projecting abutment on the casing. A trigger pinion that is pivoted in the casing engages a rack on the movable gripper in order to oscillate it against the expansive action of the spring. An electric cable with a pigtail twist is connected to the movable gripper and to a power source.

» «

Soldering Iron

2,340,829. **George Louie Ward,** Northwood, England, assigned to **International Standard Electric Corp.,** New York City. Filed Dec. 24, 1941. Issued Feb. 1, 1944.

In this soldering iron, a pair of electrodes are positioned in spaced parallel relation and united by an insulating support at one end. A metal bit holder is adjustably secured at right angles to one electrode, and a carbon rod is secured between the other electrode and the bit holder. The rod is heated by the current which flows from one electrode through the bit holder to the other electrode, and the heat is conducted from the rod to a soldering bit that is detachably fitted to the bit holder.